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# CITY GOVERNMENT

## IN THIS NUMBER:

How to Obtain a Good Asphalt Street at the Least Possible Cost—S. F. Peckham, Ann Arbor, Mich.

The Disposal of Municipal Waste—W. F. Morse, New York City.

The Filtration of Water—Edmund B. Weston, C. E., Providence, R. I.

Garbage Disposal—H. A. Andrews, Atlanta, Ga.

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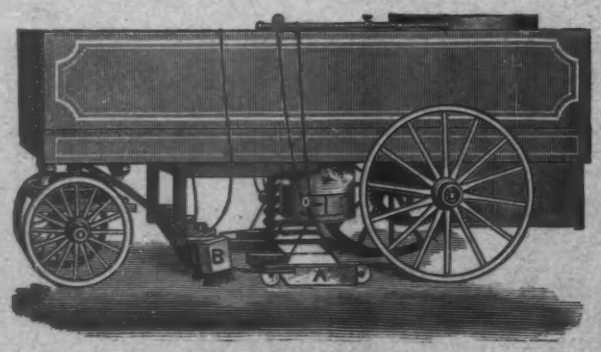

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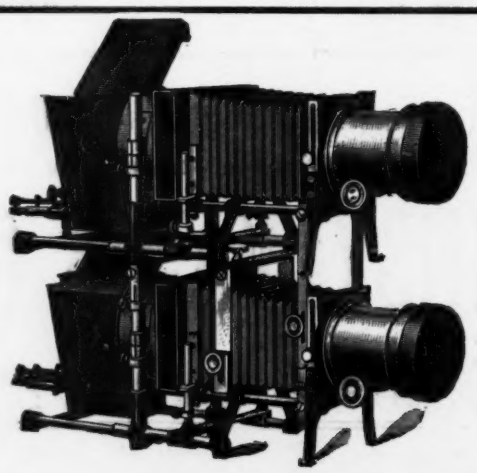

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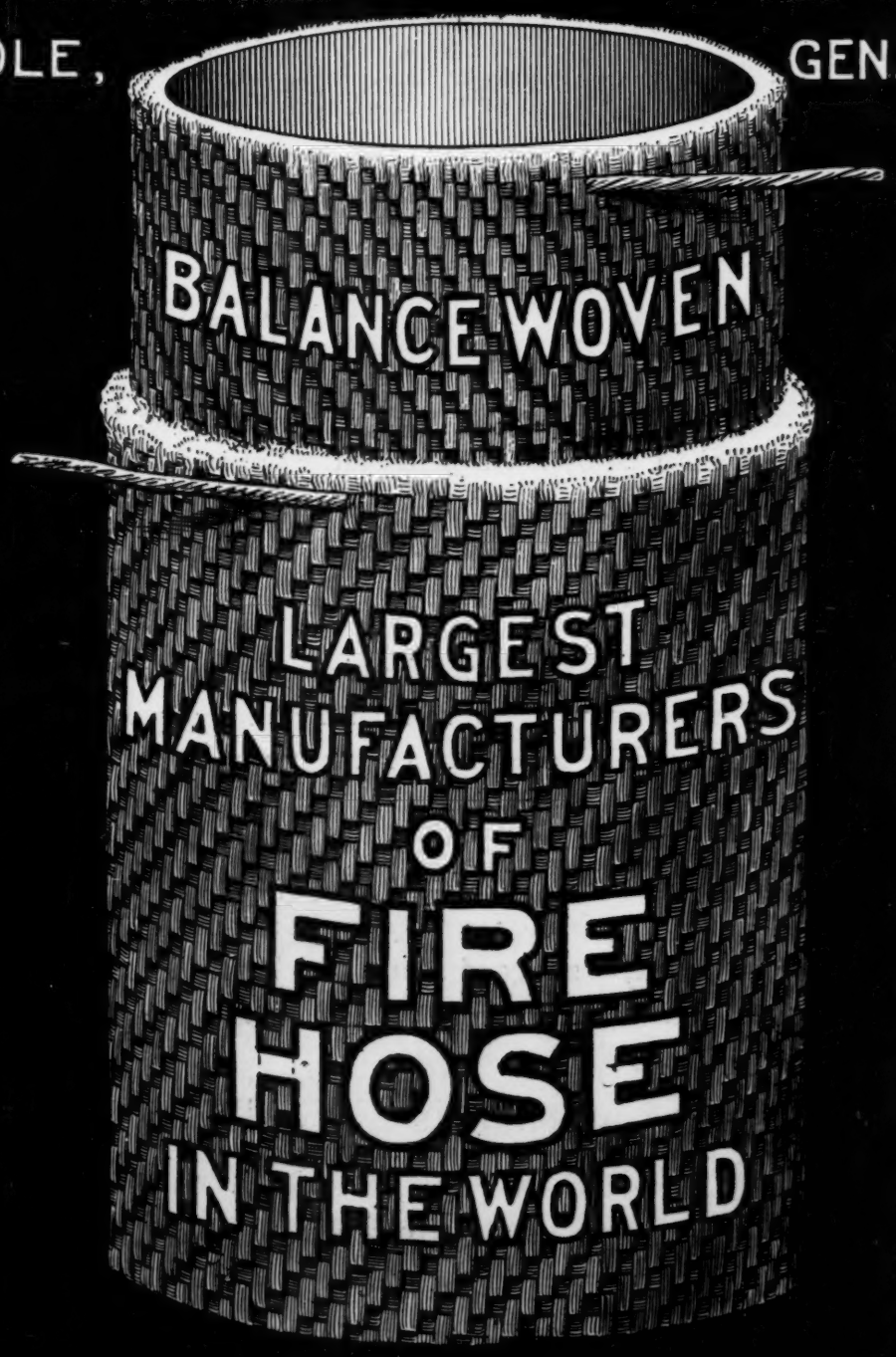


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|---|---|---|---|---|---|---|
| 5/8 in. | 100 | 28m. | 34 | 7 | 100 8/10 | 100 |
| | | **28m.** | **34** | **7** | **101** | |
| 1/2 in. | 100 | 40m. | 34 | 22 | 100 7/10 | 100 |
| | | **40m.** | **34** | **22** | **101 2/10** | |
| 3/8 in. | 50 | 30m. | 34 | 28 | 50 5/10 | 50 |
| | | **36m.** | **34** | **28** | **50 6/10** | |
| 1/4 in. | 50 | 1h. | 34 | 32 | 51 | 50 |
| | | **1h.** | **34** | **32** | **51 2/10** | |
| 1/8 in. | 25 | 2h. | 34 | 33 | 25 6/10 | 25 |
| | | **2h.** | **34** | **33** | **25 7/10** | |
| 1/16 in. | 25 | 5h. | 34 | 33 | 25 1/10 | 25 |
| | | **5h. 8m.** | **32** | **31** | **25 1/10** | |
| 1/32 in. | 25 | 19h. | 34 | 33 1/2 | 25 6/10 | 25 |
| | | **19h. 35m.** | **32** | **31 1/2** | **25 5/10** | |

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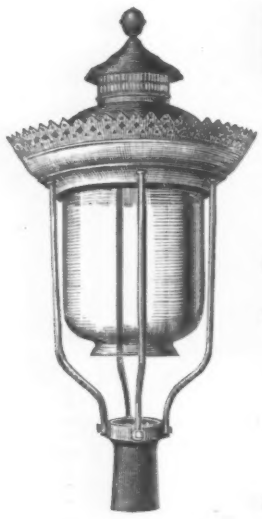

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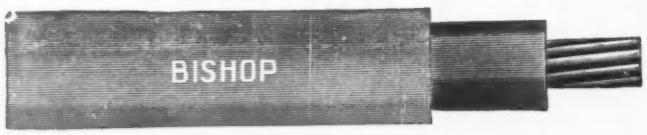


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# CITY GOVERNMENT.

[Entered as Second-Class Matter at the New York, N. Y., Post Office, August 12, 1896.]

VOL. 3. NO. 5. NEW YORK, NOVEMBER, 1897. $3 A YEAR.

## HOW TO OBTAIN A GOOD ASPHALT STREET FOR THE LEAST MONEY.*

BY S. F. PECKHAM, ANALYTICAL CHEMIST, ANN ARBOR, MICH.

When I was honored with an invitation to address this audience the broad subject of asphalt was suggested as a suitable topic. Upon reflection, I concluded that asphalt streets was really the subject in which this audience is interested, and I therefore selected as a theme an answer to the question: "How to Obtain a Good Asphalt Street for the Least Money."

Even so-called asphalt streets are not constructed of asphaltum. They are concrete roadways, upon which is spread a wearing surface of natural bituminous limestone, or an artificial imitation thereof, consisting of asphaltum tempered with sand and lime.

The use of these roadways began in France about sixty years ago, and progressed there along certain lines of investigation and improvement until the French engineers had established as the result of experience certain facts which they deemed fundamental. These may be stated as follows: That a well-drained soil be used as a foundation; that a clay foundation is very bad; that sand is but little better; that a foundation penetrated by water is liable to great injury from frost; that under all conditions 9 inches of concrete would ensure a satisfactory roadway; that under ordinary conditions 6 inches of concrete is sufficient; that for some purposes 4 inches is sufficient.

Some work done in London and Paris, that proved very expensive experiments, in which lime mortar was used instead of Portland cement, showed that under the conditions obtaining in this technology the lime mortar would never set, and is wholly unfitted for such use. Other attempts to use Roman and ordinary hydraulic cement proved their great inferiority for this purpose to a good quality of Portland cement. Therefore the engineers settled upon 6 inches of concrete, made of a good quality of Portland cement, mixed into a gravel, with a proper quantity of clean, sharp, broken stone that would not easily pulverize. Upon this concrete, well rammed or rolled to a proper contour, was laid in the European cities a surface of bituminous limestone, called in the French language *asphalte*. Experience has demonstrated that this material should be about 2½ inches thick.

This European asphalte consists of chalk, completely saturated with a very pure and stable variety of bitumen. For use it is only necessary to heat it to a moderate temperature, when it disintegrates and falls to a powder. The powder is screened while hot and laid upon the concrete bed and rolled until cold, when it becomes resolidified into a tough, elastic, compact sheet of asphalt.

Experience taught the French engineers that there was no practical difference in asphalt from several European deposits; that it was easily ruined by overheating; that if rolled too cold the street was of inferior quality; that if put down in wet or frosty weather it was likely to crack and disintegrate; in fine, that while the manipulation was very simple it required constant attention to many minute details to make a first-class street surface. Experience also demonstrated that these first-class surfaces were unsurpassed for beauty and cleanliness, and would last until they wore out—twenty years or more. Furthermore, they were found to be easily repaired without the necessity of closing the street to traffic; all of which properties have made them the best streets ever put down.

*Address delivered at the Columbus Convention of the League of American Municipalities.

It was further discovered that when this asphalt was melted with Bastennes tar or other soft bitumen and mixed with gravel and lime or sand a mastic was produced that could be easily transported and used in the construction of sidewalks or even roadways.

In the preparation of these mastics quicklime was found to be preferable to limestone dust, and natural mineral tar or maltha, like Bastennes tar, was found to be greatly superior to the tarry residuum of the schist oil or petroleum refineries.

When the question of introducing such street surfaces in to the cities of the United States was broached, the promoters of such an enterprise were confronted with the fact that at that time no deposits of bitumen resembling the European asphalt were known in the United States. When, where and by whom the first roadway in the United States in which asphaltum was used was constructed I am quite sure is not now known. It was unquestionably in one of the Pacific Coast towns of California, and the date was some time prior to 1865. It was made, however, of asphaltum, tempered with sand. At that time there were large masses of natural asphaltic sandstone scattered along the coast above Santa Barbara, in the neighborhood of where the mines of the Alcatraz Company have since been opened. These masses were mostly beyond mean low tide, projecting upwards from the bed of the ocean. They consisted of nearly one-half very fine sand and asphaltum. At the time of my first visit to the Pacific Coast in 1865-6 this material had been in use for some years, and was preferred for street surfaces to any artificial mixture of sand and asphaltum that could be made with mixers then in use.

Between the above-mentioned date and the time of my second visit in 1893-94, a number of deposits, essentially of the same material, had been opened, and many miles of streets had been laid in the towns and cities of California. From an entirely independent experience, with a somewhat different material, the same lessons have been learned that were learned by the French engineers, viz., that the best natural materials can be spoiled by inattention to details, and that overheating the asphaltum and laying in wet weather will ruin the best asphalt-surfaced street that can be undertaken.

It is generally understood that the first asphalt-surfaced street laid in any Atlantic Coast city was laid by De Smidt in front of the City Hall in Newark, N. J., in 1870. He had learned the art in France, and came to this country some years earlier. While he has left no record concerning the materials that he used, it is to be presumed that he made his mastic in imitation of that used in France, which was made of bitumen extracted from the Seyssel rock, quicklime and sand, softened or fluxed with the tarry residum of the petroleum refineries. He no doubt used instead of Seyssel bitumen Trinidad pitch.

De Smidt had already taken out a number of patents for asphaltic mastics, in which the bitumen used was the grahamite of West Virginia. These mixtures, however, were not practical. The grahamite was a hard, dry asphaltum, wholly unfitted for such use, and was held at a very high price, as it could be used for many purposes for which Trinidad pitch could not.

Trinidad pitch had been imported into the United States for many years prior to 1870. It had been used as an ingredient of roofing mixtures. It was perfectly natural that it should be used for street surface mixtures. At that time there were several firms upon the island who dug it when it was most convenient, and sold it to anybody who wanted it. Some of it without doubt came from the lake, but the most of it was taken from more convenient points nearer the beach and outside the lake. No reason

at that time existed why the fiction that there were two deposits and two kinds of pitch, since called lake and land pitch, should be promulgated; hence, no one knows whether the pitch that De Smidt used was dug on the lake or outside of it, but there is every reason for believing that it was dug from the slope outside the lake.

It was recognized from the first, as it had been in France earlier, that preparations made from coal tar were inferior to the residues of the petroleum refineries, and also that these residuums are in turn inferior to the natural malthas for the purpose of fluxing or softening asphaltum. It is probable that De Smidt used petroleum residuum as a flux, as it was then nearly impossible to obtain anything else. Experiments were later made with other materials, and one notable instance deserves mention, where Franklin avenue, in Buffalo, N. Y., was laid in 1878, presumably with land pitch, fluxed with wax-tailings.

A large amount of pitch was refined and sold to pavers in different parts of the country by Cyrus M. Warren, who bought his crude pitch where he could get it cheapest, or imported it himself.

This first street was considered a success, and it was soon followed by similar streets in other cities. In ten years the city of Washington and several other cities became noted for their fine asphalt surfaced streets, and the laying of those streets became an extensive and lucrative business. Up to this time all of the bitumen that went into these streets was contained in Trinidad pitch, which was brought from the island to the United States by thousands of tons. Then a gentleman conceived the idea of rounding up and consolidating all of the interests represented in winning pitch and exporting it from the island. He went down there, and with consummate diplomatic skill obtained a lease of the entire lake for forty years, and also some kind of an agreement from the Colonial Government by which no pitch could be dug from Grown lands outside the lake for a distance of 3 miles. This gave him a corner on the lake, but not quite one outside of it, for the Duchess of Dundonald and other parties controlled tracts outside the lake containing unknown but enormous quantities of pitch.

The laying of asphalt surfaced streets had become so important a department of public works in the city of Washington, that about 1876 the office of inspector of asphalts and cements was created and De Smidt was made the first incumbent. He was probably the best selection that could have been made for that purpose. His health failing, after a few years he was succeeded by Mr. Clifford Richardson, a graduate of Harvard and an accomplished chemist. Mr. Richardson took hold of the problems of his department with vigor, and soon issued an exhaustive report that showed the inferior quality of coal tar products for purposes of street paving. In course of time a very dirty cargo of pitch was sent up to Washington from Trinidad, dug outside the lake, which Mr. Richardson at once condemned as unfit for use. Mr. Richardson testified at the Peoria trial that he had been discharging the duties of his office two years before he discovered that there were two deposits of pitch at Trinidad. This cargo is known as the cargo of the tiest cargo ever sent from the island. I have also been told, when in Trinidad, by parties who saw it dug, that it was the dirtiest cargo ever sent from the island. I have also been told by one in a position to know the facts, that this cargo, after being condemned, was refined and laid into asphalt-surfaced streets in one or more Western cities.

The condemnation of this cargo led not only to the discovery that there was lake and land pitch, but also to the discussion of their relative merits. Finally, at the request of Mr. Richardson, the Department of State authorized Hon. W. P. Pierce, then U. S. Consul at Port of Spain, to investigate and report upon the general subject of Trinidad pitch. Mr. Pierce in course of time forwarded to Washington a most valuable and exhaustive report, in which he showed, among many other things, that there was but one deposit of pitch on the island of commercial value, and that there was no essential difference between the pitch inside and outside the so-called lake.

This report did not satisfy Mr. Richardson, and he soon after went to Trinidad himself. Later he made a report on Trinidad, in which he maintained, in opposition to Consul Pierce and many others who have written on Trinidad for the last 100 years, the essential inferiority of all pitch found outside the lake.

This so-called lake fills a depression in the summit of a truncated cone that lies between the Bay of Pavia and a range of hills in the southwest part of the island. The surface of the lake is circular, and embraces about 114 acres. It is said to be 148 feet above mean tide level. On the northeast side the rim of sand has been broken down and the contents of the lake have flowed down into the sea, forming a gently sloping surface of pitch more than a mile long. As the pitch flowed out of the lake it spread like a fan, forming a mass that has been likened to a lava flow, or a glacier. As it entered the sea this flow encountered the resistance of the waves, and was thrown back upon itself, forming a barrier reef, for a short distance along the coast. The surface of this overflow, as well as much of the lake itself, is covered with a more or less dense tropical jungle, that sometimes takes fire, producing sufficient heat to melt the surface of the pitch into what is termed iron pitch. The pitch, both within and without the lake, is full of water, but occasionally a detached mass will dry out and undergo a sort of decomposition, resulting in what Mr. Richardson calls chocolate pitch. Neither the material of the barrier reef, nor iron pitch, nor chocolate pitch, has any commercial value, nor are they sent from the island by anyone engaged in shipping pitch. Moreover, iron and chocolate pitches are formed both within and without the lake, but are everywhere excluded as rubbish by those who dig the pitch.

Now, when Mr. Richardson made his report, he submitted tables of analysis, one of lake and one of land pitch. For his lake specimens he took a number of samples from the surface of the lake, carefully excluding both iron and chocolate pitch. For his land specimens he included samples of commercial pitch taken outside the lake, samples from the cargo of the Teneriffe, chocolate pitch and iron pitch. No wonder he succeeded in producing a striking contrast. The unfairness of this comparison can only be fully understood by visiting Trinidad and learning that, if their weight in gold was offered for a cargo of these refuse chocolate and iron pitches, it is doubtful if enough of them could be secured on the island to make one, while the commercial pitch outside and inside the lake is estimated at several millions of tons.

When Mr. Richardson made this report he was an officer of the United States Government. He is now the chief expert of the parties who control the Trinidad lake. He was succeeded in his office at Washington by Mr. A. W. Dow, of whom I shall have occasion to speak further on.

At the time the corner was made effective upon the pitch lake of Trinidad it was supposed that the Trinidad deposit contained about all of the material on the Western continent that was available for the construction of street pavements. Since then deposits of vast extent have been found at several points within the territory of the United States and Mexico. Competition no longer lies between so-called lake and land pitch, but between Trinidad pitch, Bermuda asphaltum, German, French and Sicilian rock asphalts, California asphaltums, Utah rock asphalts and gilsonite, Indian Territory asphalts and bitumens, Kentucky rock, etc. Which of these is the best, no one knows. Against the most persistent and unfair competition good streets have been laid with all of them, and it can be safely said that there have been no worse streets laid with any of them than some of the streets laid with Trinidad lake pitch. It is probable that under the varying conditions existing over the vast territory covered by the United States, that no material, no formula and no method of manipulation can be uniformly adopted with equal and unvarying success. The surface that will answer the climatic demands of New Orleans must of necessity be a very different surface from that required in Boston or Buffalo. From the vantage ground of being first in the field, by persistent accretion on any and all occasions, by

arguments wholly sophistical and methods of comparison that will not stand a moment's scientific investigation; in fact, that would be driven in derision from any learned society, the impression has been spread abroad, not only that so-called lake pitch is greatly superior to anything else upon the market for the construction of street asphalt pavements, but that city governments use any other material at their peril.

In consequence of the promulgation of this fiction nearly all other requirements of a good asphalt-surfaced street are lost sight of, and many cities have been led to use only one article among several that may be as good or better, and to destroy competition in the laying of their surfaces by using specifications with which compliance is well nigh impossible. What I am endeavoring to impress upon you is this truth, that every municipality whose officers embody in their specifications for asphalt streets in any form of language the requirement that "the asphalt used shall be equal to the best Trinidad asphaltum obtainable from the pitch lake in the island of Trinidad, unmixed with coal tar or any of its products," at once places itself in the hands of those who control the pitch lake of Trinidad, without a possibility of successful competition; for the reason that the qualities of the best asphaltum obtainable from the pitch lake in the island of Trinidad are a pure abstraction; they cannot be stated in language nor illustrated by experiment nor exhibited in a specimen which can be imitated. The crude pitch, as it is found in the lake or outside of it, is not used for street paving, but a product of its manufacture called refined pitch. The crude pitch varies to such an extent that pieces broken from a lump as big as one's fist will not give identical results when analyzed by any process in use. It varies infinitely within certain limits. Then it is refined by several different methods, each of which produces results of its own. The refined pitches look so near alike that experts cannot tell the difference between them; they are practically so near alike that no man can inspect a street and say which was used in its construction; and yet, when tested, they are not absolutely identical.

For this reason if a controversy arose respecting the merits of two samples of lake pitch, the question as to which is the best would be settled as a matter of judgment and opinion, and not by demonstration. This being the case with different samples of Trinidad pitch, which is a substance *sui generis*, there being nothing like it anywhere else in the world, how can other bitumens be compared with it that do not resemble it in any respect, except as being forms of bitumen that do not need refining, that are more than 90 per cent. pure, while crude lake pitch is less than 40 per cent. pure; how, I say, can they be compared except by use—and use has demonstrated that good streets have been made of every material that I have mentioned.

I have, for the sake of simplifying this discussion, left out all consideration of the other ingredients of the street surface—the sand, the lime, the flux, the time of year when it is laid, the temperatures used, the proportion of bitumen in the mixture, etc., all of which are essential elements in the construction of a good street, because the practical operation of the specifications generally in use has fixed attention upon the bitumen alone. Yet, all of these items enumerated are of equal importance with the source of the asphalt; some of them of much greater importance, for without careful attention to them any asphalt will be ruined and a good street rendered an impossibility.

I wish to illustrate what I have been saying by a practical illustration, and I select this illustration because the facts that I shall relate have been stated under oath. The city government of Peoria, Ill., concluded to improve Perry street, one of the finest residence streets in the city, by laying an asphalt-surfaced street. The commissioner of public works advertised for bids, and bids were received from A and B. The specifications called for the use of asphalt that shall be equal to the best asphaltum obtainable from the pitch lake in the island of Trinidad, etc. The bids were opened, A had bid $2.26, and B, $2.19 per square yard. Thereupon an agent of A went to Peoria and took the commissioner of public works and the city engineer on a ride, after which the bids were rejected and bidders were asked to bid again. At the second bidding A bid $2.26, and B bid $1.85 per square yard. All requirements as to bonds being complied with, B was awarded the contract. It was understood that B did not intend to use Trinidad Lake pitch; he was not required to use it. He went to work and set the curb, laid most of the concrete in an unexceptionable manner, and had made a good beginning on the asphalt surface, when the commissioner of public works addressed a letter to the gentleman in charge of the work, in which he used the following language: "I have caused a thorough inspection and analysis to be made of specimens of portions of the asphaltum now at your factory in the city of Peoria, Ill., and the same falls far short of the requirements of the contract and specifications for the construction of the Perry street improvement which your company now have under way." Without going into the details of this case I wish to show you in what manner the commissioner of public works for the city of Peoria proceeded to cause a thorough inspection and analysis to be made.

He went or sent to the storehouse of B, and had chopped from the surface of each of two barrels a piece of refined pitch. I have since examined samples cut from these barrels, and found them to be of an average quality of refined Trinidad pitch. I have told you that the crude pitch may be refined by several different methods. While the differing results are sometimes perceptible on an analysis of the pitches, they are not in the finished street. The object of refining is to remove the water found in the crude pitch, together with mineral and organic impurities. If the pitch is refined by simply melting it, a number of samples would have a general resemblance and would require a certain amount of oil or flux to soften them when used. If, as Mr. Richardson says in his reports is the custom of the Barber Company, a portion of the oil is added in refining, the refined pitch will be quite different, and will require less oil or flux when used. If a quantity of the most desirable pitch to be found in the lake was divided into two portions, and one was refined without oil and the other with it, they could not fairly be compared by any method of comparison, as the oiled specimen would invariably appear to be the best.

Now, the commissioner of public works sent the pieces that were chopped out of the tops of the barrels to the Engineer Commissioner of the District of Columbia, from whom Mr. Dow, who had succeeded Mr. Richardson as inspector of asphalts and concretes, received them. Mr. Dow made what he called a preliminary examination, and condemned the Peoria samples as inferior. Did he make a thorough and complete inspection and analysis by methods generally in use among chemists for the analysis of asphaltums? Not at all. He whittled out two cubes, one of Peoria pitch and one of a standard sample of pitch, and putting them on a glass plate in an oven with a glass door, proceeded to note the temperature at which they first softened and then flowed down the plate. Did the Peoria sample stand this test? Of course not. The standard sample determined the whole matter. If the standard sample was oiled in refining, there was no unoiled pitch in the lake that would stand this test. Where did Mr. Dow get his standard sample? Did he get it from a disinterested party who prepared such samples for use from uniform materials, by a uniform process, yielding uniform results, well known and recognized by all parties concerned? Not at all. He said he got it from the Cranford Paving Company, who received it through a spout from the Barber Asphalt Company's refinery. This refined pitch was oiled in the still according to Mr. Richardson, and I beg to remind you of what I have just said about oiling pitch in refining. The man who refined the pitch used on Perry street, at Peoria, said that it was not oiled. Of course it did not stand this test, which determines absolutely nothing respecting the fitness of a sample of pitch for paving purposes.

Mr. Dow is a very refined and obliging gentleman. When we met at Peoria I persuaded him to promise to send me a

sample of standard lake pitch. In course of time I received it. He wrote me that it was not oiled, and that he saw it run out of the Barber Asphalt Company's still into the box. The box was 5x4x3½ inches. The pitch was 3 inches deep from top to bottom. I took a bit and bored down from the top to the bottom and carefully divided the chips as they came out into seven portions. There was so much oil in it that it had separated upon cooling, proving beyond any question that the pitch was oiled. I proceeded to analyze the chips by solvents. I found that I could not weigh two separate grammes that would analyze alike. The petroleum ether soluble, which Mr. Richardson insists determines the value of a pitch, varied in the portions of chips which I examined from 39.397 per cent. to 46.821 per cent.—the highest being from the middle of the box.

Now, I pray you, gentlemen, observe the force of what I am about to say. If Mr. Dow had used as his standard specimen a cube cut from the middle of the box of pitch that he sent me, and had compared with it other cubes cut from the bottom and top of the same box, by the same method that he described as the one he used for testing the so-called Peoria specimens, he would have condemned them both as unfit for street paving. Do you say that such a procedure is child's play? I agree with you. Yet it was upon just such a basis of child's play that the commissioner of public works of the city of Peoria first ordered stopped the laying of the asphalt surface upon the nearly completed concrete, then refused the contractors any estimate upon the curbing and concrete, which were both laid according to contract, and then upon the finished street, which, I believe, is generally considered the best asphalt-surfaced street in Peoria. It is on just such child's play as I have described that the city of Peoria has refused to pay for this street, forcing the contractors to carry the cost of construction, amounting to $60,000, for several years, and to enforce their rights first in the District Court, then in the Court of Appeals and now before the Supreme Court of the State of Illinois.

Another method of procedure by which a board of public works may defeat itself has been illustrated this summer in the city of Detroit, Mich. The board advertised for bids for a new surface for one of the principal streets. A, B and C bid. C was found to be the lowest, and was about to be accepted, when A made a second bid at about 50 per cent., I am told, of his first bid, and got the contract. The best part of the season had been wasted in the wrangle for the contract, and the chances are that the street will be finished after the weather will be unsuitable for such work. But, it is asked, didn't they give it to the lowest bidder? I reply, not the lowest bidder in fair competition; for, gentlemen, in the long run, these streets will not be laid for less than cost, and, in the long run, such tactics as have been allowed at Detroit will destroy competition and permit A to furnish such asphalt-surfaced streets at such prices as he sees fit.

I have thus far presented the negative side of the question, and out of a number that I might have cited I have shown you three methods of procedure through which city givernments cannot obtain good asphalt-surfaced streets. I will now offer for your considerations some suggestions concerning an opposite procedure.

I have enumerated about a dozen different varieties of bituminous minerals from which good asphalt-surfaced streets have been constructed. I am not sure that they have all been used in any one place. It is not probable, nay, hardly possible that any one of them can be used all over the United States from Minneapolis to New Orleans and San Diego with equal success. When I was in New Orleans in 1893 they were removing the Trinidad pitch from St. Charles street, and putting gravel in its place. A gentleman who resided upon the street told me that one day a loaded team had stopped in front of his house, and the wheels had sunk in the soft asphalt, and they had to use jack screws before it could again be started. A few years ago an attempt was made to lay an asphalt street in Minneapolis in December. It was a complete failure. Why, gentlemen? I have seen in Minneapolis in December the thermometer 40° below zero, and snowing with a gale of wind. There are all sorts of reason that really determine the fitness of an asphaltum or an asphalt mixture for use in a given locality. Some of these reasons belong to chemistry and technology, and some of them are commercial. No one has yet proved by demonstration that out of the dozen varieties that I have mentioned, other things being equal, one of them is better than the other shown; yet, I have not the slightest doubt that, judged on their qualities for use in street surfaces alone, that one half of them are better than the other half. If cities want good asphalt-surfaced streets, each city should encourage the widest competition possible. It is of no consequence to those who pay for and use asphalt-surfaced streets here in this city of Columbus whether the contractors get their bitumen in Utah, California, the Indian Territory, Kentucky or Trinidad, or whether it is in one form or another in its crude state, or whether it is called by one name or another, so long as they have a good, durable street for the least money.

The first and proper thing for the cities themselves to do is to employ a competent technologist to determine by suitable investigations and tests which and how many of the bituminous minerals on the market that have made good streets in other places can be safely used under the climatic and other conditions controlling the particular city under consideration. I do not intend by this advice that a young and inexperienced person, just out of college, should be consulted, simply because his services can be had cheaply, nor that the city engineer shall fit up a laboratory and hire such a person to run it. Engineers are very seldom chemists. While chemists make analyses, the value of chemical investigations lies in the collation and interpretation of the results of analysis and the application of scientific principles to the solution of technological problems and the correction of errors and mistakes.

The money that the city of Peoria is spending to avoid paying for the best street that it has got would pay a competent chemist for several years of research upon these problems.

The members of city governments have no adequate idea of the extent and importance of these problems. Bituminous minerals, such as are used in street paving, are among the most complex minerals in the world. Some of them consist of mixtures of bitumen with other mineral and organic matters. The separation of these complex mixtures in such a manner that the desirable and undesirable ingredients may be estimated at their proper value is the task of the chemist. The task is one requiring professional skill and experience and a great deal of time. There has been no thorough and exhaustive analysis of any bitumen used in street paving yet made, so far as I am informed. Yet I am repeatedly receiving specimens of bituminous minerals of the size of a hen's egg, with a request that I make a thorough and complete analysis and report, giving my opinion as an expert of the adaptability of the material for street paving. When I tell those who send them that I want a barrel of material, several months' time, and a corresponding compensation, they reply as if they thought me wholly unreasonable. I have not yet gained a very clear idea of the precise amount of information that these gentlemen think necessary for a basis for an expert opinion. No doubt much misapprehension exists from an acceptance of the prevalent idea that a very general identity exists in bitumens, and that the determination of the total amount of bitumen in a bituminous mineral constitutes an analysis. Such an idea is a great mistake. A very important element in nearly all bitumens is the sulphur present, and not only the amount of sulphur present should be determined, but the manner of its combination. The sulphur is not only important in itself, but it is a very important consideration in the manipulation of the bitumen.

A while ago the director of the Rensselaer Polytechnic Institute, at Troy, N. Y., sent me such specimens in a cigar box, with such a request, and said he would like to have a comparison of his material made with Trinidad pitch and Alcatraz asphalt. He seemed to think I had a perfect right to use results that other clients had paid me for, for his benefit. Of course, if he chose, he had a right to have Trinidad pitch and Alcatraz as-

phalt examined, and a comparison made with his own material. When I told him that I would do the work if he wanted it done, but that it would take several months' time to complete it and cost a considerable sum of money he was dissatisfied, and, as I think, wholly without reason.

There are no two bituminous minerals that are obtained from widely separated localities that contain the same kind of bitumen. In using them for street paving these differences are sometimes of great importance, and at other times of less consequence. A bitumen wholly unfit for one locality may be admirably adapted to another. The fact that Pacific Coast bitumens have made good streets in Los Angeles and San Francisco is of itself no proof that they can be used in New York or Minneapolis. Nor is the fact that an asphalt will make a good street in New Orleans any proof that it will make one equally good in Chicago. As I have said before, each city should investigate and determine these problems for itself, and then allow the widest competition possible under the same chemist as an inspector; not only of the laying of the street surfaces, but of all the materials that go into those surfaces; not only of the materials that contractors propose to use, but of the material that they *do* put in, and not only the quality but the quantity of material that goes in.

The careful consideration of all these questions, the inclusion of all of them in specifications, and the faithful fulfillment of all the terms of contract are the vital elements involved in every proposition relating to asphalt-surfaced streets. The kind of bitumen and the locality from which it is brought are in themselves wholly insignificant matters, the sole end in view being to secure the handsomest street for the greatest number of years for the least outlay.

In conclusion, therefore, I would again remind you, that, in order that cities may secure good asphalt streets for the least outlay, each city should employ a skilled technologist to ascertain what bituminous minerals are best suited to the construction of asphalt streets within its borders; that this list should be made to include the largest number possible; that bids should be received from any responsible bidder who would agree to use any of the bitumens named; that local bidders should be preferred to those at a distance; that unless collusion was evident the job should be let to the lowest bidder at the first bidding; that the amount of the bids should never be made public until after the contract is let; that a skilled inspector should be employed permanently by each city, who should rigidly enforce all of the terms of the contract respecting every ingredient that may be used, not only with reference to the quality but to the quantity of those ingredients; finally, that the criticism of one contractor respecting the materials or workmanship of a competitor should never be allowed a place in the judgments of city officials respecting these questions.

All of which is respectfully submitted, with thanks for your kind attention.

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—Good brick paving, well laid, is good enough for Meadville, and councils should not add to the burdens which property owners have voluntarily taken upon themselves by ordering pavements which are needlessly expensive. Block asphalt has been fairly satisfactory for the few years it has been down on the very wide streets in the residence portions of Washington, but it is not enough better than brick to warrant any increase in the cost, and it is an open question yet if it is as good as brick. Get good brick and have them well laid—that's all we need ask or can afford to pay for in Meadville.—*Meadville, Pa., Journal.*

—The Boston Board of Health, in their annual report, say that the present method of dumping garbage at Fort Hill wharf is a source of increasing nuisance and well-founded complaints, and needs immediate attention. The board recommend that at least one crematory be instituted at Fort Hill wharf at once.

## THE FILTRATION OF WATER.*

BY EDMUND B. WESTON, CONSULTING ENGINEER, PROVIDENCE, R. I.

The value of filtration for the purification of water has long been recognized by scientists. Among the facts that can be mentioned in favor of the filtration of questionable water supplies are the following: The removal of turbidity; the removal of taste and odor; the prevention of typhoid fever, cholera, diarrhœa and dysentery. Statistics show conclusively that in communities where efficient filters are used for the purification of water supplies that the yearly death rate has been largely reduced since the introduction of filtration.

It is the intention of the writer to discuss and describe in this paper the purification of water by sand filtration and by mechanical filtration aided by the application of chemicals. This latter combination will be hereafter mentioned in this paper as the American system of filtration.

The ideas and opinions of the writer which are presented, are based upon a long study of different methods of filtration; upon personal examinations of existing filter plants in the United States and Europe; upon personal experience gained by designing filter plants, and upon knowledge derived from the results of a series of experiments with sand filters and filters representing the American system of filtration, that were conducted under the personal direction of the writer at Providence, R. I., from February, 1893, to February, 1894.

Water can be satisfactorily purified by sand filtration or by the American system of filtration, and either of these methods of filtration can be depended upon, if they are well managed, to remove, on the average, from 97 to 99 per cent. of the ordinary bacteria contained in water, and very nearly 100 per cent. of the typhoid fever germs, if there should be any present in the water that is being filtered, provided that filters are employed that are constructed in a first-class manner, and in accordance with the latest knowledge that has been derived from experimental experience.

### SAND FILTRATION.

An ordinary sand filter may be briefly described as a tight reservoir, properly underdrained, and containing a bed of 5 or 6 feet deep of stratified filtering material of increasing degrees of fineness, commencing at the bottom with broken stone or coarse gravel, and ending at the top with a layer of 2 or 3 feet of fine sand. The unfiltered water is run on to the top of the filter bed, and is generally maintained at a depth of about 4 feet above the same. The purification of the water takes place during its passage down through the filter bed to the underdrains.

The rate of filtration through the English filters averages about 2,000,000 gallons per acre per twenty-four hours, the Lawrence city filter was designed to filter at an average rate of 2,000,000 gallons per acre per twenty-four hours, and the filters recently constructed at Hamburg, Germany, filter at an average rate of about 1,700,000 gallons per acre per twenty-four hours. In Germany, by direction of the Imperial Board of Health, the maximum rate of filtration has been fixed at 4 inches per hour, which is equivalent to about 2,600,000 gallons per acre per twenty-four hours.

A filter bed, after it has been in operation during a more or less length of time, becomes clogged, on account of a slimy layer that gradually accumulates upon the top of the filter bed, which consists of a jelly-like substance of bacterial formation, and the matter formerly in suspension in the water. When the resistance due to the clogging of the filter bed gets to be too great to allow the passage of the water through it at the desired rate, it is necessary to scrape the top of the filter bed. This is done, after the water has been drawn off, with sharp shovels or hoes, and about one-half of an inch of the top of a filter bed is removed each time that it is scraped. This surface layer, before it causes too much resistance to allow the passage of the water

* Paper read at Columbus Convention of the League of American Municipalities.

through the filter bed at the desired rate, is decidedly beneficial, as it acts as a very fine strainer.

The quantity of water filtered per acre between the times that a filter bed is scraped, depends upon the condition of the water being filtered. In a number of German filter beds the average quantity filtered per acre between scrapings has not been far from 50,000,000 gallons. In the English filter beds the number of gallons filtered between scrapings is much greater, on account of the large sizes of the sedimentation basins through which the water passes before it reaches the filter beds. It has averaged as high as 88,000,000 per acre.

It may be assumed that the period which elapses between the times that the majority of filter beds are scraped ranges from one to six weeks; varying according to the rate of filtration, the size of the sedimentation basins, if they are used, and, as stated above, upon the condition of the water being filtered.

In good practice, the sand removed from a filter bed by scrapings is replaced about once a year with new sand, or with the sand that has been removed, after it has been thoroughly washed.

At various places in Europe the filtered water is wasted for a time, immediately after a filter bed has been scraped. It appears to be the rule at Berlin, Germany, and of a number of the London water companies, and in accordance with the best German authority, to allow the water to stand in a newly scraped filter for about twenty-four hours before filtration is commenced, in order that a thin layer of deposit may be formed upon the filter bed. At Altona, Germany, the water is generally allowed to stand from ten to twelve hours in a newly scraped filter, previous to its being put in operation, and if a filter has had new sand placed in it the filtered water is allowed to waste for several days before being considered suitable for use. The Lawrence City filter does not appear to be disadvantageously affected by being scraped. This filter, however, is generally worked intermittently; that is, after a certain length of time the application of the water is discontinued, and the filter bed allowed to drain and get thoroughly ærated before water is again applied.

European experience, as well as that with the Lawrence City filter, shows, on account of the difficulty in scraping a filter bed when it is covered with thick ice, that it is advisable to cover or roof over a filter, if, at the place where the filter is located the mean temperature of the coldest month of the year is below the freezing point.

The percentage of water bacteria removed (that is, the percentage showing how much less the number of bacteria was in the filtered water than it was in the unfiltered water) by the Lawrence City filter and the best European filters, averages, for the entire year, between 97 and 99 per cent. The reports of the Massachusetts State Board of Health for the years 1893, 1894 and 1895, give the average percentage of water bacteria removed by the Lawrence City filter as 97.58 per cent., 98.46 per cent., and 98.22 per cent. The percentage of bacteria removed by some of the experimental filters used at the experiment station of the State Board of Health of Massachusetts has averaged, "for months at a time," between 99 and 100 per cent. The percentage of bacillus prodigiosus removed by these experimental filters has been very nearly 100 per cent. The life history of the bacillus prodigiosus is similar to that of the bacillus typhi abdominalis, and it was added to the water before it was filtered, in order to ascertain the efficiency of the filters in regard to the removal of typhoid fever germs.

Experimental filters at the experiment station of the Massachusetts State Board of Health during the year 1894, removed 43 per cent. of color and 55 per cent. of albuminoid ammonia, from the applied water.

The Lawrence City filter that has been mentioned in the preceding pages, which the writer considers the representative sand filter of the United States, has an area of filter bed of 2½ acres, and has been in operation about four years. The construction of the filter was based upon the results of a long series of valuable and elaborate experiments that were conducted at the experiment station of the Massachusetts State Board of Health. About two years ago the designer of the filter recommended that it be roofed over, owing to the difficulty experienced in scraping the filter bed in winter on account of the thick ice forming over it, thereby reducing its efficiency as well as increasing the expense of maintenance.

### COST OF SAND FILTRATION.

The following estimates were prepared by the writer, and represent first-class design and construction. They were based upon an average rate of filtration of 2,000,000 gallons per acre per twenty-four hours, and a maximum rate of 2,500,000 gallons:

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| Filter Beds Covered with Masonry Vaulting— | |
| Cost per acre of filter bed | $70,000.00 |
| Cost of construction per 1,000,000 gallons capacity per twenty-four hours | 35,000.00 |
| Total cost of filtering 1,000,000 gallons, including expense of operating, interest, deterioration, etc. | 7.57 |
| Filter Beds Covered with a Wooden Roof— | |
| Cost per acre of filter bed | $43,813.00 |
| Cost of construction per 1,000,000 gallons capacity per twenty-four hours | 21,906.00 |
| Total cost of filtering 1,000,000 gallons, as above | 6.85 |
| Filter Beds Not Covered— | |
| Cost per Acre of Filter Bed | $38,829.00 |
| Cost of construction per 1,000,000 gallons capacity per twenty-four hours | 19,415.00 |
| Total cost of filtering 1,000,000 gallons, as above | 6.48 |
| Filter Beds Not Covered— | |
| Cost per acre of filter bed | $31,063.00 |
| Cost of construction per 1,000,000 gallons capacity per twenty-four hours | 15,532.00 |
| Total cost of filtering 1,000,000 gallons, as above | 5.09 |

The first three estimates are intended for filter plants that could be located where the mean temperature of the coldest month of the year is below the freezing point. The third estimate takes into consideration a reserve area to compensate for ice forming over the filter beds. The fourth and last estimate is intended for a filter plant that could be located where the mean temperature of the coldest month of the year is above the freezing point. None of the estimates include the cost of sedimentation basins.

### THE AMERICAN SYSTEM OF FILTRATION.

A filter of the best type of the American system of filtration can be roughly described as a tight, upright cylinder of wood or steel, having a bottom but open at the top, containing a bed 3 or 4 feet deep of finely crushed quartz or fine sand, which is placed over finely perforated disks that are located at the bottom of the cylinder and attached to collecting pipes. These perforated disks allow the water to pass through them during the different operations of working the filter; downward while filtering, and upward during the process of washing the filter bed. They prevent the sand or quartz, or any foreign substance, from entering the collecting pipes and passing off with the filtered water. The cylinder has also an inlet pipe, an outlet pipe connected to the collecting pipes, wash and waste pipes, and an adjustable mechanical rake or agitator for stirring up the filter bed when it is being washed.

The filtered water flows on to the top of the filter bed and thence down through it and the perforated disks, to the collecting pipes. The chemicals are systematically added to the unfiltered water, by a small pump, before it enters the filter.

The rate of filtration of the American system of filtration is very high in comparison with the rate of filtration of sand filters. Consequently, a filter bed of the American system of filtration has, on account of getting clogged, to be washed much more frequently than sand filter beds are scraped. A filter bed can be thoroughly washed, however, in about ten minutes. The length of a run of a filter, or the length of the period which elapses between the times that a filter bed is washed, is dependent upon the condition of the water that is being filtered. During the Providence experiments it averaged about seventeen hours.

Too much time would be required to discuss in detail, all of the chemicals that have been the most frequently used in the purification of water, and, as within the writer's experience, the use of sulphate of alumina has given the best results, it will be the

only chemical which will be discussed hereafter in this paper in connection with the American system of filtration. The sulphate of alumina is applied to the water, in the best practice, in the form of a coagulant. The coagulant used during the Providence experiments was composed of one part of sulphate of alumina dissolved in seven parts of water.

The clogging of the filter bed is due to the gradual accumulation upon its top of a layer consisting of aluminic hydrate and matter formerly in suspension in the water. To this layer the efficiency of the filtration is largely due, as it acts during filtration as a very fine strainer, and in a manner similar to that of the slimy layer that has been mentioned as forming upon the top of a sand filter bed. When the resistance, due to the clogging, gets to be too great to allow the passage of the water through the filter at the desired rate, it is necessary to wash the filter bed.

The theory of the American system of filtration when sulphate of alumina has been added to the applied water, may be described as follows: The alumina causes an artificial precipitation. A portion of the alumina is decomposed, forming sulphates of other bases and a flocculent precipitate of aluminic hydrate. A portion of it also combines directly with the organic matter present in the water, coagulating the same and thus helping to increase the precipitation. The degree of color of the water is also largely reduced by the uniting of the precipitated aluminic hydrate with the coloring matter in the water. A sufficient quantity of the precipitate having been deposited upon the top of the filter bed, it is ready for service.

The manner in which a filter is operated is as follows: At the end of a run, or immediately before starting the filter, the filter bed is thoroughly washed by forcing up through the perforated disks and filter bed a reverse flow of water under pressure, the mechanical rake or agitator being operated at the same time, which adds materially to the efficient cleansing of the filter bed. The water is forced up through the bed and the agitator kept in motion until the water flowing from the overflow drain-pipe it as clear as it was before it was used for washing the filter bed. The necessary valves are then operated and the unfiltered water, to which the sulphate of alumina is being added, is turned on to the filter.

During the Providence experiments a very satisfactory rate of filtration was found to be 128,000,000 gallons per acre per twenty-four hours. At this rate a filter 12 feet in diameter would have a capacity of about 332,000 gallons per twenty-four hours, and a filter 21 feet in diameter, about 1,000,000 gallons per twenty-four hours.

The principal features of a first-class filter plant, having a capacity of 20,000,000 gallons per twenty-four hours, can be roughly outlined as follows: A filter house, 250 feet long and 64 feet wide, containing a flume about 8 feet wide running lengthwise through its centre, for receiving and taking away the filtered water; twenty filters, each of 1,000,000 gallons capacity, ten of which are located on each side of the flume; the supply and wash pipes for bringing the water to the filters; the drain pipes for removing the dirty water during the process of washing the filters; the steam pipes for sterilizing the filter beds and heating the building, and all other necessary pipes and appurtenances. An engine and boiler house 60 feet square, containing the boilers for supplying the steam; a pump for washing the filters; an engine for driving the shafts in the filter house, which work by the aid of belting the mechanical rakes in the filters when they are being washed; an automatic chemical pump for adding the sulphate of alumina coagulent to the water being supplied to the filters; the tanks for mixing and holding the coagulent; the air-pump for aiding in the mixing of the coagulent: and the electric-lighting and signaling apparatus; and a shed or small building for storing coal and sulphate of alumina in bulk.

The most efficient filter plants that have recently been constructed make use of sedimentation tanks, as adjuncts to the filters, through which the water passes before it enters the filters. These tanks are sometimes built independent of the filters, and sometimes they are located directly under the filters, the lower part of the cylindrical shell containing the filter bed being arranged and utilized for the purpose. When sedimentation tanks are used, the sulphate of alumina coagulant is added to the water as it flows into the tanks.

It was demonstrated during the Providence experiments that if any of the alumina found its way through the filter while the proper quantity was being added to the unfiltered water, it was such a minute quantity that it could not be determined by the chemical analyses that were made, as the amount that was found in the filtered water was less than the amount found in the unfiltered water (one of the constituents of the unfiltered water being alumina, before the sulphate of alumina was added to it). Many chemical analyses have been made in different places where filter plants are in operation, in order to ascertain if any of the applied alumina or alum that was being used passed through the filters, and almost invariably the same result is reported; namely, that none of the applied alumina or alum was found in the filtered water.

Objections are sometimes raised against the American system of filtration, to the effect that it requires a great deal of care and attention. There are but few things which bring about successful results that do not require more or less care and attention. The principal details which have to be attended to during the operation of a large filter plant are: The mixing of the coagulant; seeing that the proper quantity of coagulant is being added to the unfiltered water, which is easily done by adjusting the automatic chemical pump to the required rate; the operating and care of the engine, pumps, boilers, and mechanism used for working the mechanical rakes during the washing of the filters; the opening and closing of the necessary valves which are made use of in washing the filters; the regulation of the quantity of water being supplied to the filters; and, about once in six months (dependent upon the character of the water), the sterilizing of the filter beds, which is generally done by covering them with water, to which should be added a small quantity of soda ash, and then boiling the water by forcing steam into it from the boilers.

It is the opinion of the writer, that it does not require any more responsibility and attention, and possibly not as much, in running a large first-class filter plant, than it does to run an average plant of high-grade pumping engines of the same capacity.

It was found during the Providence experiments that, by the American system of filtration, there could be removed from the unfiltered water 98.6 per cent. of the water bacteria; 99.97 of the bacillus prodigiosus, that was added to the unfiltered water in order to ascertain the efficiency of filtration in regard to disease germs; 70 per cent. of the albuminoid ammonia; and about 72 per cent. of the color.

The writer received a short time ago trustworthy information in regard to the bacterial efficiency of two large filter plants that have recently been built; one of them is of 6,000,000 gallons capacity, and the other of 3,000,000. The results derived from eight samples of the unfiltered and filtered water that were collected on eight different days from the former plant showed an average removal of water bacteria of 97.2 per cent.; and the results obtained from samples of the unfiltered and filtered water that were collected daily for three months from the latter plant showed an average removal of water bacteria of 97.9 per cent. (the results of the last two months averaging 98.0 per cent).

### COST OF THE AMERICAN SYSTEM OF FILTRATION.

This estimate was prepared by the writer and includes the cost of sedimentation tanks. It represents first-class design and construction, and was based upon an average rate of filtration of 128,000,000 gallons per acre per twenty-four hours:

| | |
|---|---|
| Cost of construction per 1,000,000 gallons capacity per twenty-four hours | $13,500.00 |
| Total cost of filtering 1,000,000 gallons, including the expense of operating, cost of sulphate of alumina at the rate of one grain per gallon at $1.75 per 100 pounds, interest, deterioration, etc. | 6.41 |

The above estimate is intended for a filter plant that could be located anywhere without regard to the mean temperature of the coldest month of the year. For a climate where the mean temperature of the coldest month of the year is above the freezing point the cost would be somewhat less. The writer considered one grain of sulphate of alumina per gallon in the estimate, as it may be considered as a fair general average of the quantity that would be required for a large number of differently constituted waters; some waters require less and some more; six-tenths of a grain per gallon was the average amount applied during the Providence experiments.

Several large and efficient filter plants that have been constructed within the last two years did not exceed a cost of construction of $10,000 per 1,000,000 gallons capacity per twenty-four hours. The total cost of filtering 1,000,000 gallons, taking into account these figures instead of the $13,500 as given above, would be $5.73.

CONCLUSION.

It will be seen by comparing the estimates of cost which are given in this paper, that the cost of construction per 1,000,000 gallons capacity per twenty-four hours of an American system of filtration plant, as well as the cost of filtering 1,000,000 gallons, is less than that of a sand filtration plant.

A comparison of the third estimate of the cost of a sand filtration plant (which is the lowest of the first three estimates, and, therefore, may be considered conservative) with the estimate of the cost of an American system of filtration plant; namely, $19.415 and $6.48 for the former; and $13,500 and $6.41 for the latter—shows that the cost of construction per 1,000,000 gallons capacity per twenty-four hours of a sand filtration plant is about 44 per cent. more than that of an American system of filtration plant, and the cost of filtering 1,000,000 gallons about 1 per cent. more.

Experience has shown that the percentage of color removed is much larger by the American system of filtration than by sand filtration.

The percentage of removal of albuminoid ammonia has been shown to be larger by the American system of filtration than by sand filtration.

The percentage of removal of the applied bacillus prodigious, which represents typhoid fever germs, has been shown by experimental filters to be about the same for both systems.

As can be seen by the percentage, given in the paper, the average percentage of removal of water bacteria of the Lawrence City filter during three years, and that of an American system of filtration plant during two months, is practically the same. The writer is of the opinion, however, that it is quite possible to build sand filters in this country which would be as efficient as the best European sand filters, and, although it may be quite as possible that American system of filtration plants can be built which would be equally as efficient, the experience in regard to building and operating first-class plants of the latter system has not yet covered a sufficient length of time to enable the writer to express a positive opinion in this respect. He will, therefore, assume that the best European experience tends to show that a sand filter is 1½ per cent. more efficient in the removal of water bacteria than the American system of filtration. If this assumption is correct, does the extra cost of a sand filtration plant compensate for its 1½ per cent. increase of efficiency in the removal of water bacteria? The writer is of the opinion that, possibly, in some cases it might; but in many cases that it would not.

For instance: a sand filter plant having a capacity of 10,000,000 gallons per twenty-four hours, considering, as given above, an increase in the cost of construction of about 44 per cent., and an increase in the expense of operating, etc., of about 1 per cent., would cost $59,000 more than an American system of filtration plant of the same capacity, and the expense of operating per annum, etc., would be about $256 more. It should be remembered, as has previously been stated, that the figures of the cost of construction that have been considered in this comparison, include the cost of sedimentation basins for the American system of filtration plant, but that they do not for the sand filtration plant.

The statement has sometimes been made in regard to the American system of filtration that "the use of alum is injurious to health." The writer has already discussed this objection quite fully, and it is hardly necessary for him to state that, in his opinion, there need not be any apprehension felt in regard to the use of alum or sulphate of alumina, if they are applied in a manner which conforms to the latest experimental knowledge and practical experience.

In closing, the writer wishes particularly to emphasize the fact, that the opinions which he has expressed in this paper in regard to the comparative efficiency of American system of filtration plants which are in actual service, have been based upon the operation of first-class plants that have been built in accordance with the most advanced knowledge (derived from late experimental research) that there is upon the subject. The writer also wishes to state that his opinions, as above mentioned, do not in any manner refer to the general run of "mechanical filters" which are in use in the United States or elsewhere.

## THE DISPOSAL OF MUNICIPAL WASTE.*

BY W. F. MORSE, NEW YORK CITY.

This is a subject of such magnitude that an examination in the detail of the various systems and appliances in use would require considerable time by the speaker, and a vast patience on the part of the auditors. It is not the present purpose to go minutely into details, but rather to sketch in outline the several methods and apparatus, and try to formulate, for practical guidance, the results that have been reached.

Under the term "garbage" is usually included every kind of municipal waste. But for our purpose a more accurate classification is necessary. All waste may be divided into two classes: Organic, meaning that which will, by decay and putrefaction, cause offense and may become dangerous; and Inorganic, substances which do not decay, but by accumulation become troublesome. Organic waste, or garbage, as herein used, means the vegetable and animal offal from dwellings, hotels, markets, etc., but does not include the contents of cesspools and privy vaults. Inorganic waste, or dry refuse, is held to be paper, straw, rags, leather, wood, rubbish, glass, iron and every kind of worthless dry matter excepting ashes.

Garbage, as it comes from houses, contains from 60 to 80 per cent. of water held in suspension, 3 per cent. of grease, 5 to 7 per cent. of rubbish, glass, crockery, cans, rags, etc., and 20 per cent. of dry animal and vegetable matters. It should be collected from covered iron garbage cans at the household, and placed in steel watertight cars, with an iron or canvas cover, drawn by one horse and attended by one man. The cubic capacity of such a cart is 45 feet, and the weight of this load about 2,500 pounds. For long hauls it is more economical to use a large wagon with two horses. The garbage must be gathered quickly, covered from sight and smell in transit, and the carts be kept clean. The separation of garbage from other matters must be made by the householder. When mixed with ashes and rubbish no satisfactory screening or sifting can be done; it is useless for reduction, is burned with difficulty, and if used for filling ground makes trouble in future.

We are warranted in assuming that the old ways of waste disposal are to be abandoned. Public sentiment, educated and stimulated by years of remonstrance and protests on the part of sanitarians and health officials, demands reform. Garbage is no longer to be heaped upon the boundaries of communities, is not to be thrown into streams and lakes to pollute the water supply, will not hereafter be cast into the water harbors to obstruct navigation and defile adjoining shores, shall not be fed to domestic animals to produce swill milk and trichinous pork,

* Paper read at Columbus Convention of the League of American Municipalities.

but under new order and conditions will be turned to useful purposes.

There are two general systems of improved garbage disposal in this country. These are:

Reduction, or utilization, which manipulates the waste and recovers a certain proportion of merchantable products; and

Cremation, or absolute destruction by intense heat.

All the reduction methods proceed upon the general plan of steaming in digesters, or cooking tanks, as the first process; the variations in the several processes arising from the different methods of extracting the grease and treating the tankage, or residuum. One company uses steam only, and by heavy pressure drives off the water and grease that are afterward separated, drying and grinding the remainder. Another employs naphtha as the agent for securing the fats, afterward separating the grease and naphtha by distillation. Still another company adds sulphuric acid at some stage of the work, and recovers a part of this afterwards.

A ton of garbage treated by reduction is reported by good authority to contain these items of theoretical value, at the best market quotations:

| | | |
|---|---|---|
| Grease, 40 lbs. at 3c. | | $1.20 |
| Tankage containing | Ammonia, 13 lbs. at 8c. | 1.04 |
| | Phosphoric Acid, 13 lbs. at 1c. | .13 |
| | Potash, 3 lbs. at 3½c. | .10 |
| Making a total of | | $2.47 |

The actual money value of this product varies with the units of plant food that are present, as shown by sample analysis, and the market quotations and supply of low-grade fertilizers. The success or failure of each company or process depends upon the economy of their operation, and their ability to recover the largest amounts of grease. Just at this point comes the cities' interest in this work, and in pursuit of reliable information the various conflicting claims and statements put forth by rival processes, when compared, seem to be irreconcilable.

Reduction plants have been established in seventeen cities in the past eight years. Of eight plants built by one company four are now operating. Of three plants by another company only one survives. Another process tried in two large cities was abandoned in each after a year's work. Of the ten cities now using reduction processes, five are working upon the same plans and five others are still in the experimental stages, operating four different and separate processes. Each of the abandoned plants was paid a bonus of from 50 to 75 cents per ton for treating the garbage, and each found it impossible to do a profitable business.

The secretary of one company, in a recent publication, said: "The factories of this and other companies erected and operated for the destruction of garbage, that is to say, refuse animal and vegetable matter, cannot be and will not be a financial success unless a large bonus is paid by the city to help along the work. Revenue from the sale of products will not pay expenses."

This statement is directly opposite from the claims put forward by the promoters of rival companies to the effect that they can, if necessary, reduce garbage at a profit without a bonus from the city. But these are statements, merely, and not proven by the exhibit of figures. It remains to be demonstrated which is correct. The usefulness of reduction systems seems to be limited to the Northern cities. In the warmer climates of the Southern cities the difficulties attending the collection and separation of the garbage, together with the expenses of marketing the products, absorb the profits unless a large bonus is paid by the cities.

One objection to reduction methods is the fact that the work cannot be carried on in the vicinity of dwellings without creating foul odors and causing complaints. This compels the locations of the factories to be at long distances from the districts of collection, and adds to the city's expense for transportation.

It seems to be demonstrated that reduction methods cannot profitably handle less than 25 tons daily of selected kitchen offal, and necessarily must be limited to places where this quantity is constant the year through. For the transportation of garbage by rail from any neighboring place is a matter that can hardly be done with success.

The constituents of municipal waste in most communities are: Ashes, 50 to 65 per cent; dry refuse, 30 to 45 per cent; garbage, 17 to 20 per cent. of the total collection.

Reduction, taking garbage alone, can only deal with one-fifth of the waste, and leaves the remaining four-fifths to be cared for by other means. It does not cover the whole field of waste disposal, and should properly be considered as only one of the means at the command of the city, and must be taken in connection with other and more extended methods that provide for the whole bulk of worthless matters.

### CREMATION.

The disposal of waste by cremation has been practiced for twenty years abroad, and for ten years in this country. Beginning in 1887, with one public garbage-cremating furnace, there are fifty-eight cities and towns now using cremation furnaces for waste. There are ten or twelve different styles of furnaces in the market, and more on the way. Every class of combustible waste, garbage, refuse, rubbish, night-soil, dead animals, etc., is destroyed, and every kind of fuel—coal, coke, wood, gas (natural and fuel), and oil—is employed.

There are three types or separate classes of cremators in use, two of which have passed the experimental stage, while one is yet upon trial. One style is copied largely from the Siemens regenerative furnace, uses gas as fuel, and has five plants in operation. Another, with one furnace just beginning work, is a modified form of the destructor used in Great Britain. The third type of furnace may be called the "American," of which there have been fifty-seven built in ten years, thirty-four of these being constructed under the patents of one company. There are seven or more variations of this American type of cremator, differing in the modes of feeding, flue construction, and the use of secondary fires for destroying inflammable gases and smoke.

The general plan of all is a rectangular brick structure, with the width and height each about one-third of the length. On the top are feeding holes, through which the material to be destroyed is deposited on transverse grates. The fires are at one end, the heat and flames passing over the garbage, and by means of a third flue still lower are conducted to the chimney placed at the other end. At some point during the passage of the smoke a second fire is placed, which intercepts and destroys the carbon contained in the smoke and the inflammable gases from the material consumed.

The furnaces are lined with firebrick, are braced and strengthened with rods and angle bars, and provided with a stack of brick or smoke pipe of large diameter, carried up from 50 to 75 feet. A covering house of wood, iron or brick encloses the furnace, and the work of dumping is done through the doors from outside the house, or the cart drives inside and discharges its load directly into the furnace. Driveways and platforms give approach to the top from the roadway below.

The chief objections urged against cremating furnaces are the emission of offensive smoke and fumes, the outlay for repairs, the expensive operating, and in some cases may be added the difficulties in finding a suitable location.

The sanitary side of this question is undoubtedly the chief consideration. Once it is decided to destroy waste by fire, the furnace selected for this work must do it without creating a nuisance. That it can be done is proven by numerous examples. That it is not always perfectly done is because of faulty construction, or of negligence of attendants. With the improved and lately perfected types of destructors, provided with chimneys of the required size and height, garbage can be destroyed without offence in the centres of populous communities if reasonable attention is given to the details.

The selected furnace should be built with the utmost care, of special material, with the heaviest and most solid construction that can be had. Heretofore this work has been too slight to withstand the strain, and interminable stoppages and expensive repairs are the result. Insist that the work shall come up to a

certain standard, and that a guarantee shall be made for durability; then enforce this contract, and the cost for repairs will be greatly lessened.

The location of a cremator is often a matter of the greatest difficulty; no one wants it as a neighbor, though everyone is willing his neighbor may have it. Sites unwisely chosen entail trouble and litigation, ending in the abandonment of the whole plant. But with patience and care in selecting there can always be found a suitable place. And, once established, if carried on with reasonable skill that comes by experience, there is no trouble in continuing.

The expense of operating is governed chiefly by the cost of fuel. In New England, with high prices for fuel and labor, garbage burning costs double what it can be done for in localities where fuel is cheap.

It must be remembered that every ton of household garbage contains 1,400 pounds of water to be evaporated before combustion begins, and that the heat-producing value of garbage when burned in closed furnaces is less than one-twentieth the value of an equivalent amount of coal. Hence garbage itself must not be taken into account as fuel unless means are taken to first dry it. An enormous saving in the cost of operating garbage crematories can be made by using the worthless rubbish for fuel. As a rule this refuse is now collected with the ashes and dumped; or if collected with garbage it becomes saturated with water and useless for fires.

The dry refuse of a city comprises at least 30 per cent. of the total waste collection. In this is included not only the usual daily amount of useless matter that every household sends out, but also the thousand articles and substances that are discarded as worn out and worthless. The actual value of this refuse is far more than is imagined. The statement made by Colonel Waring that one-half cent per capita per day can be recovered from the rubbish, and will pay the cost of all the street cleaning, garbage collection and disposal, is the most significant fact developed by his work in New York city. That it will be done is only a question of time and opportunity.

One agency by which this will be done in New York city may be briefly described. This is a waste disposal station to be built at East Forty-eighth street, having a capacity of 100 loads, or 500 cubic yards of dry refuse, which will daily be brought to the station from a district of the city containing about 250,000 inhabitants. The loads are discharged and spread out thinly upon a wide conveyor, or endless chain of steel plates, slowing moving. The first, or preliminary, sorting removes the glass, iron, leather, carpeting, clothing, wood and bulky articles. These are placed in bins, or, worthless, are carried at once to the furnace. From the ground floor the conveyor carries the waste to the second floor and discharges onto another series of moving tables or picking troughs, at the end of which is a large storage bin holding 150 cubic yards. During the passage of the waste it is sorted by the "pickers" placed on each side of the moving belt, into hoppers connected with baling presses below. Five grades of paper and five classes of rags are separated and baled. The remainder (about 10 per cent. of the original bulk of refuse) is destroyed in a specially designed refuse destructor. The heat thus obtained is passed through steam boilers and power is furnished for moving the machinery. Power for electric lighting, or for any other purpose, can be had up to 100 horse power. The revenue from sale of recovered articles will not only repay the cost of operating, but also the fixed charges for rent of ground and interest on construction, and become a profit to the city. If the steam power can be fully employed the revenue rises at once to a considerable sum, as steam power in New York city is worth $35 per year per horse power. This is not a theory on paper, but an accomplished fact. One station of this kind already operating takes 200 cubic yards of refuse, sorts out and saves 90 per cent., burns only what is worthless, and returns to the city a revenue of nearly $100 per week above the cost of operating.

It is a demonstrated fact that any city that will institute a separate dry refuse collection, and provide suitable apparatus for sorting and handling, can make this dry-refuse disposal method not only self-supporting, but return a revenue. Now, if we go one step further and apply this profit in the shape of heat as an auxiliary to destroy or convert the wet portions of the city waste, then we have reduced the expenses to the minimum and found a practicable, sensible, and economical solution of the whole problem.

Much has lately been printed upon the supposed value of garbage as fuel for providing steam power to be applied to municipal uses. The examples of English cities in this direction are quoted as "destined to revolutionize the economical policy of municipalities." These statements are deceptive, unless the methods used in England are clearly understood. Cremation is there the only means employed for waste disposal. The whole miscellaneous collection of a city or of a large district is brought to one station. It is there sorted, picked, screened, until everything valuable is saved, and the remainder burned. Garbage, as we know it, does not exist except in small quantities.

It is calculated that in the larger American cities the garbage, or discarded parts of food and other putrescible matters, will amount to three-fourths of a pound per day for each inhabitant of the city. This proposition, varying with the seasons, and governed somewhat by the character of the population, and also by locality, represents the daily waste that goes on year after year in this country. It is wasteful, unnecessary, needless extravagance; but so it is, and cannot be changed at once. In England the house garbage is far less in amount, since the food waste is very small, contains no water, and when put into the furnace is dried before being used as a fuel. The dry refuse and partially burned coal and clinkers screened from ashes furnishes the bulk of fuel, not the garbage. The calorific value of this fuel is subject to wide variations, is a matter of great uncertainty, and has been greatly overestimated by scientific gentlemen. English engineers whose opinions are based on personal knowledge do not sustain these fanciful statements, but are gradually and accurately working out the problems and will soon report definite figures.

The ash collection of a municipality may be divided into two classes:

Boiler ashes, comprising the coarse ashes, cinders and clinkers from the steam plants of factories, institutions, hotels, etc. This, when unmixed with other matters, finds ready sale as a basis for concrete work in foundation and floors, for which it is peculiarly adapted. These ashes are also used for brick and tile and for many other purposes.

House ashes are nearly always mixed with rubbish, tin cans, broken glass, crockery, rags, sweepings, etc., and can be only used for filling ground. Ashes comprise more than one-half the whole city waste collection, but are the least difficult matter to deal with.

In the limited time allowed for discussing this subject it is manifestly impossible to go into its many phases and sub-divisions, all of which have a certain weight and bearing on the question, but some leading considerations that must be taken into account before the selection of any special system of waste disposal, may be briefly stated.

The geographical situation of the city may determine at once for or against a proposed scheme of waste disposal. Municipal work in this line that is carried on in some cities under certain well-defined and fixed rules, cannot be done in the same way in other localities because of the limitations of climate or totally different territorial conditions.

The character of the population, their attitude with reference to proposed reforms, and their willingness to conform to strict sanitary regulations respecting separation and collection enters into this question. For instance, the regulations requiring separation of garbage and its collection in a condition to be used for reduction purposes could not be carried into effect in the city of New Orleans, and a change from reduction to cremation was made necessary.

The amount of waste and the increase in quantity caused by

presence of a large temporary population should be approximately known. This is a most difficult thing to settle. There is a more or less accurate report of so many cartloads gathered, but no figures that give different proportions of each class, and usually there is found a complacent state of profound ignorance or uncertain guesswork as to quantities and character.

The question of direct municipal control as against the contract system for a term of years, is the one which will perhaps be the most difficult to decide. The example of our elder brethren across the water, where all work of this kind is done directly by the city employees, emphasizes the fact that better results at lower cost can be had by municipal work than when it is placed in the hands of contractors. For one thing, the responsibility rests directly upon the city, and is not divided and sub-divided among a series of irresponsible subordinates, whose sole purpose and performance is too often to get as much as they can, do as little as possible, and shirk the consequences.

Again, if any method or system will pay a profit to a company to take up the work, why should not this saving be made by the city? If any process or reduction company can demonstrate to their stockholders a sure return of dividends upon capital invested, why may not the city acquire the rights and conduct the business precisely as other departments of municipal work are carried on, with equally satisfactory results?

At the present time this subject of waste disposal is in a stage of growth and progress. But two ways or means of dealing with it are available, and the relative advantages and special adaptation to the local conditions cannot be determined without investigation and comparison. This information has heretofore been obtained by committees of municipal officers visiting the various plants, entailing great expense of time and money. But the education and training of these gentlemen does not always qualify them for examining into obscure questions of chemistry and complicated details of mechanics involved in reduction methods, or of deciding upon units of heat or technical construction in the art of furnace building employed by cremation.

The subject has gone beyond the speculative experimental stage, and reached a point where more definite and exact knowledge is needed. This can best be had by calling in the assistance of experts who will make full examinations, submit reports covering the whole ground, together with plans and estimates for the special methods or systems best adapted for their use, and will avoid the errors that have gone before, and profit by the experience acquired by all.

Finally: The indications are that a combination of the two systems of reduction and cremation is the ideal way in which to treat city waste. Each of these methods developing along parallel lines have come to a place where they begin to converge to a common point. Reduction has demonstrated its ability to secure a percentage of value at greater or less cost, according to the bulk of garbage treated, but does not provide for the still larger proportion of city waste left untouched. Cremation destroys the putrescible matters, and recovers little or nothing of value in the process, but when applied to the destruction of the large percentage of refuse furnishes a means for its treatment at a profit.

A city that will put into force a separate collection of garbage, dry refuse and ashes, that will then erect a disposal plant to reduce the garbage and operate this by steam obtained from the combustion of such portions of dry refuse as are worthless after sorting out the salable parts, can not only have its waste disposed of in a sanitary way, but will realize a profit in the operation. This may not be accomplished at once, but it is the logical, legitimate sequence that must follow the further development of the two systems now in use.

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The annual report of the Boston Board of Health shows the annual death rate to be 22.53 per 1,000, based upon an estimated population of 516,305. This rate is .07 less than that of the preceding year and the lowest since 1884.

## GARBAGE DISPOSAL.

BY H. A. ANDREWS, OF ATLANTA, GA.

The wide range of discussion under this head, the various and complicated theories advanced, the costly and impractical experiments tried, and the many disastrous failures all admonish us to get closer to the subject and point out a definite plan whereby any city or town can safely and economically dispose of all waste of every kind in a perfectly sanitary manner.

Most cities have mastered the departments of fire, police, streets, sewage, lighting, water, finance, etc., but how to dispose of the city's filth is an open question, and information is sought. Disgusted and alarmed at the old ways of dumping filth into the lakes and streams and drinking it, transporting it to distant points and piling it upon the ground, burying it in the earth and trusting air and water to scatter it, the best sanitary engineers and health officials turn to the only agent known for its destruction, and say garbage is dangerous, and should be destroyed by intense heat. It should be burned to ashes, and the ashes scattered to the four winds or used as fertilizer. This was the conclusion reached by the Massachusetts Board of Health, the American Sanitary Association, Dr. Quitman Kohnke, New Orleans, La.; Dr. Orme, Los Angeles, Cal.; Dr. James F. Alexander, Atlanta, Ga.; William Locke, Brooklyn, N. Y., and hundreds of eminent experts, who have given the subject of sanitation careful and persistent investigation.

It is not my purpose to deprecate any effort to utilize a city's waste when it can be done with safety. All would welcome such a system, but all will agree that the saving must be actual, not theoretical, and that speculation and filth, at the expense of public health, is worse than suicide. Every city must face the disposal of five kinds of waste, differing widely in character and constituency.

First—Ashes, cinders and street sweepings, which are perfectly harmless, and only need to be disposed of in any convenient way.

Second—Garbage, which is largely organic matter, and subject to rapid decay. It includes house and market waste, slop, swill, etc.

Third—Trash and combustible waste containing more or less filth.

Fourth—Dead animals of all kinds, condemned meats, fish, poultry, etc.

Fifth—Night soil from closets outside the sewer districts.

These are the five classes of waste that every city produces, and a good sanitary system should successfully dispose of everything included, without menace to the community or unreasonable expense. Of the two sanitary systems now claiming attention—"Cremation or Incineration" and "Reduction or Utilization"—I shall deal mainly with the former, for obvious reasons:

First—The latter only attempts to dispose of the second division of our city waste, leaving four distinct classes to be otherwise cared for. This is fatal to any system, and shows lack of adaptation.

Second—Reduction or utilization is ill adapted to effectually dispose of the second class of waste, even, because the citizen is called upon to sort the garbage, or it must be done at the reduction plant, where the decaying organic matter gives out offensive odors, and the premises and operation become a public nuisance.

The reduction system necessitates hauling or transporting the garbage long distances, generally over principal streets, thus increasing the danger and expense of garbage collection. Still other serious objections exist to any of the well-tried reduction systems. The extensive, costly and complicated machinery required, the financial losses uniformly incurred, the danger of strikes, when epidemics prevail in a city, the uncertainty that surrounds the system on all sides, make it impractical, and in most cities impossible, to dispose of the sorted garbage even, say nothing of the other three dangerous classes of city waste. No one would be so foolhardy as to attempt a reduction system in New Orleans to-day while an epidemic prevails in that city. I doubt if the large and costly reduction plant lying idle there could turn a wheel while yellow fever continues.

Turning from all these difficulties, dangers and losses, we find, in a thorough system of cremation, they disappear. I assume that any city or town can find places to dispose of ashes, cinders and street sweepings, the first class of city waste. Cremation disposes of the other four classes, viz., garbage, trash and combustible waste, dead animals and night soil. It will be my purpose to show exactly how it is done, and at what cost.

In order to make this explanation clear, it is necessary to describe the essential features of a typical crematory of the latest pattern. It consists of an upper and lower longitudinal furnace about 25 feet long and 6 feet wide on opposite sides of a central stack, the upper furnace to burn the solids and the lower to evaporate the liquids, and burn whatever falls through the grates. Within the stacks, on opposite sides corresponding to these large furnaces, is a combustion chamber to consume the gases and vapor from the large furnaces.

The top of the furnace is on a level with the upper floor of the crematory and the garbage, night soil, combustible waste, dead animals, etc., are dumped from the carts and wagons directly into the upper furnace through circular openings in the top. Each opening is provided with an iron cover, arranged to be easily raised while a cart or wagon is dumping in its load, or when it is desirable to stir the garbage.

A bridge wall about 5 feet from the front end of each furnace separates the garbage from the coal or wood furnace, and prevents the garbage, slop, swill or night soil from obstructing the furnace fires which play over the garbage in the upper furnace and under it in the lower furnace from the bridge wall to the stack. Between these fires the garbage is rapidly consumed by the flames eating their way through the mass and setting fire to all combustible material. Any particles falling through the grates are consumed by the flames of the lower furnace, and all liquids percolating through the garbage are quickly evaporated.

The gases, vapors and fumes created by both fires are drawn directly into the intense heat of the combustion chamber in the stack. This fire serves the double purpose of maintaining a draught through the furnace, and largely increasing the draught in the stack, but its principal utility is to thoroughly destroy the foul gases that would otherwise escape, and to complete the incineration of all organic matter.

The combustion chamber is formed by a network of fireclay pieces just above the opening from the furnace in the stack, about 3 feet above the grates. These fireclay pieces are arranged in the form of checker work; are easily and cheaply maintained at a white heat by the stack furnace, and also perform the greater office of so intercepting the draught at this point as to create intense heat in the chamber and to effectually destroy all organic matter. The addition of oxygen at this point in the stack causes the hot escaping gases to burn freely.

The night soil is emptied into the furnace the same as garbage. The liquids are rapidly evaporated and absorbed, and all escaping gases or vapors pass into the combustion chamber and are destroyed by the intense heat.

The stack is 85 feet high, and divided by a partition wall inside, which separates the furnaces and renders it practical to use either end separately. The entire furnace inside, from the iron fronts to the top of the stack, is firebrick; and no machinery, pipes, valves or dampers are used.

No skilled labor is required to operate the furnace. The ashes are of value as a fertilizer. Two men are required to operate the furnaces while garbage, night soil, combustible waste and dead animals are being delivered, and one to burn the furnace clear at night. All ashes, tin cans, and other indestructible material are raked out through the ash doors onto the lower floor, where they are wheeled or carted away by the night man.

The crematory is covered by a two-story brick or wood building of attractive architectural design, and a suitable approach or driveway leads to the second floor, on a level with the top of the furnace. Having briefly described an up-to-date garbage crematory, its advantages and economy are apparent.

First—It is absolutely sanitary, all organic matter and disease germs being completely destroyed by intense heat. This fact, well established in many cities, makes it practical to locate and operate large or small crematories in different districts of a city, and thus secure the advantages and economy of "short hauls" in collection and "quick disposal" of garbage, without any "handling." Garbage is taken up on the streets and alleys, driven to the nearest crematory and burned at once. No garbage is stored in the building, and the premises are as sanitary as the average dwelling. It also enables the health officers to prevent the spread of diseases by burning all of the city's waste near where it is produced, instead of hauling it long distances. It is an effectual and safe quarantine.

Second—It is economical, as the cost of a crematory plant is small compared with other devices; the cost of hauling is also reduced to a minimum, and time is saved by "short hauls" and "quick disposal" of garbage.

Third—Cremation effectually destroys night soil, as well as garbage, and thus solves the difficult problem of "putting it into the lakes or streams," "burying it in the ground," or "transporting it long distances" beyond the city limits. It is burned to odorless ashes in a perfectly sanitary way. This we consider of vast importance, as no reduction system known attempts to handle or reduce night soil at all, and the best of them dispose of less than 32 per cent. of all city waste, thus leaving nearly 70 per cent. to be otherwise cared for.

Fourth—Cremation makes the trash and combustible waste of the city available to burn the garbage and night soil. All the waste of house and store, such as paper, rags, excelsior, matting, sacking, bagging and trash of every kind, is better than coal to burn garbage, and the citizen is saved from separating it and maintaining the necessary receptacles for both. It is already mixed in the single receptacles. Instead of a burden and expense to the city and citizen, it becomes an economic agent to save labor and fuel in cremation. Any surplus fuel in the garbage is better used to assist in burning the night soil and slop than for any other purpose.

Fifth—Cremation is a scientific process, and is approved and indorsed by the greatest sanitary engineers and the most prominent public health officials in the world. They unite in saying "garbage is dangerous and should be destroyed by fire, and not scattered by air and water." Especially so, when contagious and infectious diseases prevail. Neither should the citizen be obliged to sort and separate garbage or maintain receptacles for that purpose.

The cost of garbage cremation varies in different cities, according to variable conditions. The cost of fuel (coal, wood, gas or oil), the price of labor, the condition of garbage when collected, whether trash or combusitble waste is mixed with the garbage or not, whether night soil is burned or not, and the manner in which the furnaces are fired and the garbage raked down, all of these conditions should be considered.

What is called pure garbage contains about 80 per cent. of water, and a small per cent. of grease and other material containing oxygen and hydrogen and carbon. Night soil is still more obstinate to burn, and contains very little combustible material; hence the cremation of these two divisions of city waste alone, or either separately, would require a larger appropriation of fuel. The third and fourth divisions, viz., trash and combustible waste, dead animals of all kinds, also meats, poultry and fish, are very inflammable, and serve as a valuable economic agent in destroying the pure garbage and night soil. They aid in reducing the cost of disposal to the minimum.

The price of fuel covers a wide range. Coal dust or slack in Pennsylvania and natural gas in Indiana reduce the cost of cremating mixed garbage to 17 cents a ton, including labor; while coal costing two or three dollars per ton in the South and other less favored localities raises the average cost considerably.

In three Southern cities the official report for two successive years shows an average cost, including labor, of 34 cents per ton, where night soil and combustible waste are included. In California, where crude petroleum is used for fuel, the cost is officially reported at 48 to 55 cents per ton. In three cities of New Jersey and Delaware the cost per ton averages about 45 cents, including labor; but trash and combustible waste are not collected with the garbage and are not burned.

I conclude that no city is warranted in trying costly experiments or attempting to do what private enterprise and unlimited capital has failed to accomplish. Less than twenty reduction plants have been established to dispose of garbage in American

cities, and not one-half of them are in operation to-day. All have been financial failures, all have received large bonuses from the cities, yet the capital stock of the different reduction companies has no known value. Boston, Washington, New Orleans and other great cities have tried the experiment, and want no more of it.

I further conclude that cremation must effectually destroy all forms of city waste that could possibly endanger public health, and that a third furnace of intense heat through which the offensive gases and vapors must pass is an absolute necessity. Also, that a suitable combustion chamber to accomplish this work must be so located and arranged as not to impede the draught of the stack, but to increase and strengthen it. Also, that the draught of the furnace should be sufficient at all times to prevent any smoke or gases escaping from the furnace doors or covers when opened or raised. With these conditions fairly met, with the draught of the furnace always in and never out, no odor will escape, and the crematory should be as sanitary as any house.

Municipal ownership of crematories ranks with that of police and fire equipments for many reasons. Public health, safety and comfort demand, first, a perfect sanitary system that can be permanently administered every day; and last, but greatest, municipal ownership and control of garbage disposal, so that no failure of contractors, intervention of courts, lack of police power, breakage of machinery, strikes or other contingencies can prevent the prompt collection and immediate disposal of city waste.

## MAYORS ELECTED IN NOVEMBER.

New York.—New York, Robert A. Van Wyck, Dem.; Buffalo, Dr. Conrad Diehl, Dem.; Syracuse, James K. McGuire, Dem., re-elected; Rochester, George E. Warner, Dem., re-elected; Newburgh, Benjamin Bodell, Rep., re-elected; Troy, Francis J. Molloy, Dem., re-elected; Binghamton, Jerome De Witt, Dem.; Utica, Thomas E. Kinney, Rep.; Oswego, John D. Higgins, Rep.; re-elected; Yonkers, Leslie Sutherland, Rep.; Albany, Thomas J. Van Alstyne, Dem.

Detroit, Mich.—William C. Maybury, Dem., re-elected.

Baltimore, Md.—W. T. Malster, Rep.

Louisville, Ky.—Mr. Weaver, Dem.

Ansonia, Conn.—Franklin Burton, Rep.

Port Huron, Mich.—Herman W. Stevens, Rep.

Providence, R. I—W. C. Baker, Dem.

Newport, R. I.—P. J. Boyle, Dem., re-elected.

## FROM THE MAYOR OF BOSTON.

CITY GOVERNMENT PUBLISHING CO.,
150 Nassau Street, New York City:

GENTLEMEN—The establishment of such a publication as CITY GOVERNMENT is an encouraging indication of the growth of interest in municipal affairs. The discussion in your columns of subjects of general interest to all municipalities cannot fail to yield valuable results. In spite of the great variety of local conditions, there are many problems in which all large cities have a common interest, and **it is most desirable that those who hold important municipal offices should keep in touch with the new developments which are constantly taking place in other cities.** I am glad to notice that you pay especial attention to the technical branches of municipal work.

Wishing your publication every success, I am,

Yours very truly,
(Signed) JOSIAH QUINCY, Mayor.

I have read with great interest each issue of CITY GOVERNMENT since its first publication, and believe it to be the only paper that properly covers the field of municipal government. Every city official in the country should be on your subscription list, as the knowledge gained by its careful reading more than repays, many times, the amount invested. I wish you continued success.—Edwin W. Fiske, Mayor of Mt. Vernon, N. Y.

## WATER WASTE AND ITS PREVENTION.

BY L. N. CASE, GENERAL SUPERINTENDENT DETROIT WATER WORKS.

Waste is defined by Webster as "a squandering," "needless destruction," and "useless consumption and expenditure." In our homes, in our stores, in our workshops and our factories, waste is reduced to a minimum. It matters not how wealthy the home, nor how flourishing and prosperous the business, any employee found guilty of deliberate waste is discharged. As a community, however, made up as it is of individual economists, we are guilty of the most flagrant wastefulness in almost all of the departments of general government.

It seems almost impossible that there should be found even one man who will knowingly advocate a system of waste, and yet we do find such men; sometimes influenced by unworthy motives, such as a desire for place or power, but more frequently in that mental condition that has a tendency to elicit a repetition of the prayer: "Father forgive them, they know not what they do."

I do not propose to enter into a discussion of the question of waste and its prevention generally, but shall confine myself to the special subject, the "useless consumption and expenditure" of a water department.

A certain candidate for a municipal office said: "I favor the idea that the water supply of a city should be as free as the air we breathe." It probably did not occur to him that water will not run up hill unless it is pushed; that the push costs money, and that the cost of the push is in proportion to the quantity of the water.

Who, I ask, would not favor the idea, if it were possible, of having water as "free as the air we breathe"? And why should we not, in this same connection, favor the idea that bread and fuel and everything that we need should be just as free?

A common principle of life, however, prevails, which prevents even a hope that such a condition will ever exist, and that is that anything that costs money to fit it for our use and bring it to our doors must be paid for. Who by? The one requiring and using it. Upon what basis? Upon the basis of the quantity consumed, as that is the basis of the expense.

Can anybody advance a convincing reason why water should not be paid for upon the same principle as we pay for our food, for the clothes that warm and the roof that shelters us?

"But," one says, "water is necessary for public purposes, for protection from fires, etc." Well, to the extent that the public requires expenditures in a water department for these purposes let the public pay. There is also a very material benefit derived in reduced rates of insurance because of the establishment of a water works in a community. I should say put it all in, and from the general tax levy take a generous sum to cover all benefits received that are in proportion to the valuation of properties; but the balance, and much the larger sum, should be paid for on the basis of consumption.

The best of thinkers will differ as to the percentage of construction and operation due to public needs, but each community should determine that for itself. This difference of opinion, however, does not weaken the principle involved. Most communities recognize the truth of this principle, and, in addition to appropriations received, assess the consumer upon the basis of his *estimated* consumption. Each use is estimated, and because of the fact that the total amount pumped is usually from two to five times the total of the estimated quantities, just that much more is charged by the assessor per unit, in order to obtain the requisite income.

For instance, in Detroit, in 1888, the last year previous to the introduction of meters, there was received in water rates, on the basis of estimated quantities, or what I call the "guess plan," $344,315. The total quantity pumped that year was 14,380,166,670 gallons of water, and we received therefor the sum as above stated, which was at the rate of 2 2-5 cents per thousand gallons. Our rates, however, were 20 cents per thousand gallons, if estimated, and 10 cents if measured.

To illustrate more forcibly the utter inadequacy and also the injustice of this guess plan I will cite one experience in the earlier days of the introduction of meters. Fourteen business houses, manufacturing and otherwise, were metered, and their first month's consumption taken as a measure of the quantities used previously. Their assessed charges imposed previous to being metered were then divided by these quantities, and it was found that these firms had been paying at the rate of from *one* cent per one thousand gallons to *twenty* cents. The only firm that had been paying at the rate of 20 cents, which was the rate at which we had figured them all, was a flouring mill, the uses of water being almost entirely for the engine, and which we were able to correctly estimate. Two manufacturing firms, both engaged in the same business, and, of course, in close competition for the sale of their products, were found, one of them paying 1 cent per thousand gallons and the other 6¾ cents for the same quantity.

In addition to this unjust discrimination there is another feature far more important. Under this estimated or guess plan no inducement is offered for carefulness or economy in the use of water, but, inasmuch as the charge will be the same, faucets are left wide open, leaking fixtures remain unrepaired, and, among at least one-half the community, no care is exercised to prevent waste and a "needless destruction" of property.

This neglect and carelessness is an ever-growing disease in a community. Take the experience of Detroit, for an example: In 1853 there was pumped an average to each family supplied of 70,000 gallons. This average steadily increased through the subsequent years, becoming in 1888, 390,000 gallons.

Another principle I saw advocated by a candidate for a municipal position: "With the never-failing source of supply of water, and with the most modern machinery for utilizing the same, water ought to be furnished freely to all our citizens without any restraint," meaning by that last word the use of meters. It is hardly necessary to say that meters do not *restrain* any more than the clerk in the store restrains the use of butter in weighing it and charging for the amount one receives.

Now, it costs as much to pump and distribute water to a community where the supply is illimitable as it does where the reverse prevails, and this cost, both for construction and operation, is in proportion to the quantity pumped.

There seems to be an idea prevailing in some brains that the only increased expense for increased quantities is for the fuel that is used to perform this additional work, when it is a simple truth that the capacities of the engines that pump the water and the pipes that carry it are as limited as that of a barrel. For instance, an engine is constructed to pump 24,000,000 gallons daily. Every additional 24,000,000, or fraction thereof, requires another engine.

In the consideration of this subject, these questions naturally arise: Why should not the same methods of economy and carefulness that prevail with us individually prevail with us also collectively? Why should one forbid a child the wasting of a match because it has to be purchased by oneself, and then permit the "squandering" of a substance that is paid for by the community at large?

It seems to me that these questions are unanswerable; and upon the hypothesis that there is no defense or good reason for the waste of water in a community, let us try to estimate what this waste amounts to, and whether the necessary expense for prevention is justified.

It becomes necessary in estimating the waste in a community to know what is a generous allowance for all its needs. The most reliable authority that I have been able to avail myself of is the report of the Royal Commission of London in 1893. This commission was composed of three eminent civil engineers, three professors of colleges and one representative of the legislature. One of the problems for this commission to solve was: What per-capita daily supply will be a generous allowance for London's future needs? As the construction of new works was contemplated, or rather the obtaining of additional supplies from distant sources, it was most important to know as nearly as possible the quantities that would be required through the coming years.

The investigation was thorough and searching. Experts were summoned from different countries, and the evidence thus obtained was recited in the report. The conclusion was as follows: "The commission, weighing the whole of the evidence, decided upon 42 United States gallons as a safe basis of calculation for London's future requirements."

The experiences of both European and American cities that measure all or nearly all of their consumption, sustain this report, and make the establishment of 50 gallons for a daily per capita supply of a city a generous and most reasonable one.

I have before me the report of the Department of Public Works of Buffalo for the year 1896. It shows a daily average pumpage of 93,984,614 gallons. It also reports the number of families supplied as 68,909, which, upon the average of 5.14 persons to a family, makes a supplied population of 354,192, and upon that basis the average daily per capita supply was 265 gallons, or over five times the necessary quantitiy.

Now, this means, if it means anything, that because of no "restraint" in Buffalo, no restriction to the carelessness and wastefulness of its people, there are *five* engines purchased and running instead of *one*, conduits of five times the capacities of those actually required, five engineers instead of one; in fact, five of everything that enters into the construction and operation of the plant instead of one. And this is called "having water as free as the air we breathe!"

Detroit pumped last year the same quantity of water that was pumped ten years previously, supplying an increased population of 100,000. We have paid out of our ordinary resources the entire expense of placing, superintending and repairing of over 5,000 meters, and, in the meantime, have continued the reduction in our rates to such an extent as to produce an aggregate reduction in our income during the last six years of $500,000.

Mr. Trautwine, of Philadelphia, one of the most distinguished hydraulic engineers in this country, says of Philadelphia: "If the consumption were reduced by meters from the present per capita rate of 235 gallons per day to even 120 gallons, which latter in many cities would be considered criminal waste, the cost of both construction and operation would be reduced practically one-half."

I am glad to be sustained by so eminent an authority.

# League of American Municipalities.

The success of the League of American Municipalities was assured by the very large and thoroughly representative attendance at the Columbus convention, and by the intense interest manifested in the proceedings of that meeting by city officials and the daily press throughout the country. The success of the league is now doubly assured by the fact that a large number of the important cities have already, by official action of councils, taken membership and paid annual dues. The league already has a sufficient number of cities on its membership roll to guarantee a permanent and successful existence, but municipalities are still coming into the fold as rapidly as the usual official formalities will permit.

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Greater New York, the second city of the world, and the first city of this great nation, is already a member of the league. At the first meeting of the board of aldermen after the Columbus convention, Alderman Elias Goodman introduced the following resolution:

WHEREAS, The League of American Municipalities has been duly organized and promises to be useful and beneficial in many respects; and,

WHEREAS, We concur in the sentiment expressed in the following paragraph taken from an official circular just issued by the said league, to wit:

"The unanimous sentiment of the Columbus convention, which was a representative body and which planned and formed the permanent organization, was that the League of American Municipalities would be promptly and cordially supported by the patriotic officials of American municipalities as a movement for the betterment of municipal conditions, with the inevitable results of facilitating departmental work, securing improved public services and lessening the burden of the taxpayers."

Therefore,

*Resolved*, That, in conformity with the provision of the constitution of the said league, as follows:

"Any municipality in the United States or Canada may become a member of this organization

"Each and every municipality becoming a member of this organization shall pay an annual membership fee on or before December 1, as follows: Cities under 25,000 population, $20; between 25,000 and 50,000, $30; between 50,000 and 100,000, $40; between 100,000 and 200,000, $50; and over 200,000, $60."

—the city of New York hereby becomes a member of the said League of American Municipalities; and also

*Resolved*, That the comptroller be and is hereby authorized to draw an order payable to B. F. Gilkison, secretary of the League of American Municipalities, in the sum of $60, in payment of one year's dues in said organization.

Under the provision of the charter which prohibits the adoption of any resolution appropriating money at the same meeting at which it is introduced, the resolution went to the finance committee. At the meeting of the board, held on November 4, Chairman John T. Oakley, of the finance committee, reported the resolution favorably, and it was adopted by the board without a dissenting vote. Mayor Strong and the members of the present New York council are enthusiastic in their support of the league, and that this support will be continued by the incoming administration is vouched for by Mayor-elect Van Wyck, President-elect Guggenheimer, of the council, and Councilman-elect Oakley, who will be the administration leader in the new municipal assembly.

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Mayor Strong, of New York, in a recent conversation with Secretary Gilkison, said: "I regret that the very important business of preparing the tax budget for the first year of the greater city was under way at the time of the Columbus convention and prevented my attendance. There is no doubt in my mind that the organization formed at Columbus is destined to accomplish great good in the way of better municipal government, and I am sorry that I was unable to take an active part in the meeting that started such an important institution as the League of American Municipalities. During the short time that I am to remain in office I shall be pleased to do what I can to help the league, because I believe it is the duty of the mayor of every city to encourage such a worthy movement."

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Mayor Maybury, of Detroit, writes to the secretary as follows: "At the last meeting of the common council a resolution was adopted that the city of Detroit shall become a member of the league, and money was appropriated for the dues. The authorities of the city concur heartily in the objects of the league, and such representatives as were present at the Columbus meeting speak enthusiastically of its main objects, with hopes and confidence that we will have a big convention in Detroit in 1898."

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An appropriately designed, lithographed certificate of membership, 8x14 in size, is now being prepared and will be sent out to members within a few days. These certificates are suitable for framing, and should be hung in council chambers or offices of city clerks. Secretary Gilkison has also issued an individual membership card, to be sent to mayors and council members of cities holding membership in the league. These cards entitle the individual holders to the services of the bureau of information and all other privileges. They are issued for the purpose of preventing imposition on the bureau of information by non-members; they also serve to keep the address of the secretary constantly in possession of the individual officials of membership cities.

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There is not a city on this continent which does not occasionally need the experience of other cities in some line of municipal work. In the adjustment of light and water rates, in the letting of paving contracts, in the adoption of garbage-disposal systems, in the granting of franchises for public-service industries and in many other matters is it possible for city governments to save vast sums of money for the taxpayers by profiting from the experiences of others. The chief purpose of the League of American Municipalities is to secure, through its bureau of information and through its annual conventions, such an interchange of knowledge and experiences as will enable city administrations to command the best public improvements and the best public service at the least possible cost.

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Honors come thick and fast upon Des Moines' modest and courageous mayor. He was recently elected president of the American Municipal League, and on Sunday night when Dr. Eaton, of the First Methodist Church, at the conclusion of a sermon in regard to some of the political dangers that assail the republic, spoke in the highest terms of Mayor MacVicar's sturdy fight for municipal ownership and his unfaltering opposition to the private interests that seek to fatten at the expense of the public, the assembled congregation broke into cheers. After all, it pays to be square. Patient and honest merit in the end triumphs.—Editorial from *Des Moines Leader*.

# CITY GOVERNMENT.

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## NOTE AND COMMENT.

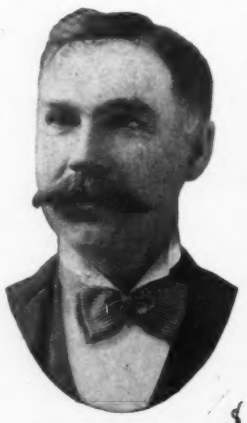
When the Democrats can beat out such a good fellow as Mayor George E. Green, of Binghamton, they must needs have a landslide—and that is what they had in nearly all of the recent municipal elections. In Greater New York the Democrats swept everything, electing their entire city ticket, their several county and borough tickets, and seventy-two out of the eighty-nine members of the new municipal assembly. Robert A. Van Wyck, the mayor-elect, was opposed by all the daily newspapers in the city, except one, but his plurality was within an ace of 100,000—all of which is a significant commentary upon the influence of the daily press in municipal campaigns. Every daily newspaper in New York has a different opinion as to what caused the success of the Democracy; CITY GOVERNMENT never lags in anything, and so it also has a divergent opinion. Mr. Van Wyck's plurality represents those citizens of New York who do not believe in that kind of municipal reform which includes in its objects the government and regulation of their individual habits. This opinion may not be sound, but we are willing to add it to the diverse expressions of the esteemed daily press gratuitously.

Jerome De Witt is the name of the gentleman of Democratic persuasion who had the good fortune to defeat George E. Green, the popular Republican mayor of Binghamton. About the best greeting it is possible to extend to Mr. De Witt is to wish that he will give the city of Binghamton an administration as good as that given by Mayor Green, who, by the way, is now closing his second term.

Mayor James K. McGuire, of Syracuse, was re-elected. He is a Democrat and a good public servant, and these two qualifications brought him success at the polls. Mayor McGuire has accomplished a great deal for the improvement of his municipality during his first term, and may be depended upon to continue the good work.

By a vote of 78 to 52 the common council of Philadelphia has decided to lease the gas works of the city to the United Gas Improvement Company. Before this issue of CITY GOVERNMENT reaches its readers it is probable that the select council will have concurred in the action of the lower branch. Taxpayers have begun injunction proceedings to restrain the mayor from approving the lease; hence some interesting litigation will be the result of the action of councils. The passing of the gas works from municipal to private control, if such happens to be the result in this particular instance, will not furnish a positive example of municipal failure. In the case of the Philadelphia gas plant there is much to be said, both for and against municipal ownership. The fact that the plant has been used as a factor in the politics of the city, and has been mismanaged accordingly, is a point in favor of the contention that it is impracticable for a municipality to engage in such an enterprise. On the other hand, it may be argued that it is possible to remove the gas works from all political influence and control. In a special article published in CITY GOVERNMENT some months ago it was shown that the Philadelphia gas plant, despite the fact that it was in poor condition as to repairs, was being operated with profit to the city. Whether the terms of the proposed lease will equalize the profits of municipal operation is a question that will most likely be considered by the courts. Until the case is determined it is wise to withhold comment.

The re-election of Mayor Taggart, of Indianapolis, by an immense plurality, and in the face of stubborn opposition, is an encouraging indication that the people appreciate efficient and faithful municipal service when they get it. Thomas Taggart is one of those men who have gained success in life by their own efforts, single-handed and unaided; in the discharge of his duties as mayor of Indianapolis he has employed the same energy in action, the same careful thought in planning, the same sagacity in executing, and the same honest purposes that have combined to make his business career successful. Indianapolis could not have a better mayor.



MAYOR TAGGART.

An event that must be pleasing to all people interested in good municipal government occurred at Chattanooga, Tenn., on the evening of October 18. It was the public presentation of a unique and substantial testimonial to the retiring mayor, George W. Ochs, by the members of the council and the citizens. The testimonial was conveyed in the form of a gilt-edged Russia leather book, in which was inscribed the sentiment that Mayor Ochs had "measured up to the full stature of an honest, painstaking and faithful public servant." The text in the book is signed by all the members of the council, and about 500 of Chattanooga's leading citizens. By his wise and careful administration Mayor Ochs saved many thousands of dollars for his city during his four years of service, and he thoroughly deserves the praises that Chattanooga people unanimously give him.

EX-MAYOR OCHS.

The first State association organized as an auxiliary to the League of American Municipalities was formed at

Fargo, N. Dak., on October 19. The officers of the North Dakota organization are: Mayor J. A. Johnson, Fargo, president; Mayor A. O. Whipple, Devil's Lake, vice-president; Mayor P. H. Rourke, Lisbon, treasurer; Auditor F. A. Brown, Grand Forks, secretary; Mayor John Dinnie, Grand Forks; Mayor W. B. Fuller, Jamestown, and Mayor Smith, Grafton, trustees. The association will meet again at Grand Forks about January 1. State associations are also being formed in Massachusetts and Florida.

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Mayor George E. Green, of Binghamton, vice-president of the League of American Municipalities for the State of New York, will retire from office within a few weeks, but his interest in the league will not be diminished a particle. Those who were at the Columbus convention know Mayor Green as the brightest man among all the bright men who were there. The straightforward, frank and convincing manner in which he spoke on the floor of the convention made him by far the most popular speaker, and he was conceded by everybody to be the best fellow about the hotel corridors. Mr. Green is not only a brilliant speaker and a good fellow, but the people of Binghamton know him as an honest, capable and energetic city official. His record as mayor of Binghamton during the past four years will stand for all time as a monument to his worth as a citizen. In a recent letter to the secretary of the league, Mayor Green says: "It will rarely happen that an ex-mayor or an ex-alderman will lose interest in municipal work simply because he happens to be a back number. I shall be glad to do all that I can, as vice-president of the league, to get the cities in line as members of the organization."

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## CONVENTION OF THE A. S. M. I.

The fourth annual convention of the American Society of Municipal Improvements was held at Nashville, Tenn., during the first week in October, and was attended by seventy-six civil engineers and public works officials, representing thirty-four cities. President Herrmann, in his annual address, reviewed the past work of the society and expressed his gratification over its success. Secretary Fulton and Treasurer Kennedy presented their annual reports, from which it was seen that the receipts for the year amounted to $1,156.99, and the disbursements to $1,131.06. The following papers were read and discussed: "The Practicability and Advisability of a City Like Minneapolis Laying and Maintaining Its Own Asphalt Pavements," by F. W. Cappelen, city engineer of Minneapolis; "Results of One Year's Work in a Chemical Laboratory for Testing Asphalt," by George W. Tillson, C. E., Brooklyn; "Paving Brick Tests," by M. L. Holman, water commissioner of St. Louis; "A Few Considerations Regarding Modern Wood Pavements," by Col. M. A. Downing, of the board of public works of Indianapolis; "Rumbling in Brick Pavements," by Ernest Adam, C. E., Newark; "The Ideal System of House-Top Construction," by John A. Cabot, city electrician of Cincinnati; "Observations on General Taxation and Special Assessments," by N. P. Lewis, C. E., Brooklyn; "The Appointment of Boards of Public Works and Engineers, and Checks Upon Their Action," by Charles C. Brown, C. E., Bloomington; "The Experience of the City of St. Louis with Respect to Street Sprinkling," by Robert E. McMath, of the board of public improvements of St. Louis; "Coating of Cast Iron and Steel Riveted Pipes," by George H. Benzenberg, city engineer of Milwaukee; "School Inspection as a Means of Preventing Contagious Diseases," by Dr. J. M. Withrow, of Cincinnati, and "Bicycle Paths," by L. W. Rundlett, city engineer of St. Paul.

The following officers were elected: Harrison Van Duyne, Newark, president; L. W. Rundlett, St. Paul, E. H. Keating, Toronto, and A. D. Thompson, Peoria, vice-presidents; D. L. Fulton, Allegheny, secretary; John L. Kennedy, Nashville, treasurer; F. J. O'Brien, Oswego, H. J. Stanley, Cincinnati, and E. W. Boynton, Davenport, finance committee.

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## VOTING BY MACHINE IN DETROIT.

The United States voting machine was used in the recent election at Detroit, and, according to the newspapers of that city, it was a complete success. It may be briefly described as a mechanical Australian ballot. A bulletin board on the outside of the booth bears an exact facsimile of the board within, from which the voting is done. Each candidate's name appears in its place, as on the Australian ballot, except that a party ticket is extended horizontaly, the name of all the candidates for a single office appearing in a vertical column. Party tickets are indicated by colors as well as by the regularly selected emblems, and a straight ticket may be voted by the pulling of a single lever. In voting selectively, the voter must pull a lever under each name to be voted for, and any combination that it is possible to vote on an Australian ballot can be voted with equal facility and greater accuracy on the machine.

The opening of the door to admit the voter automatically unlocks the mechanism and sets it to register his will. When he opens the door to go out the mechanism is automatically locked and no tampering with the indicators is possible. The pulling of any lever in a column or tier locks the device controlling the counters for all other names in that column, so that both mistake and fraud are guarded against.

The registering device insures absolute secrecy. The numbers indicating the votes cast for each candidate are concealed by a locked door until the time comes for counting, when the inspectors unlock the door and record the totals as shown. There is no way by which even so much as the nature of the last vote recorded could be learned. All that the indicator shows is so many votes for each candidate, and the opening of the door to expose the figures locks the mechanism so that the indicators cannot be tampered with.

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## AMERICAN PUBLIC HEALTH ASSOCIATION.

The twenty-fifth annual convention of the American Public Health Association was held at Philadelphia during the last week of October. Officers for the ensuing year were elected as follows: Dr. Charles A. Linsley, New Haven, president; Dr. Benjamin Lee, Philadelphia, and Dr. J. C. Schrader, Iowa, vice-presidents; Dr. H. C. Probst, Columbus, secretary; Dr. H. C. Holton, Brattleboro, Vt., treasurer; Dr. G. H. Robie, Maryland; Prof. F. C. Robinson, Brunswick, Me., and P. H. Bryce, Toronto, members of the executive committee. Next year's convention will be held at Ottawa, Canada.

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—Edward B. Guthrie, the well-known chief engineer of the city of Buffalo, has resigned and accepted the position of engineer to the grade crossing commissioners of that city. This change is in the nature of a promotion, as Mr. Guthrie gets an increase of $1,000 a year in salary.

WM. V. INGHAM, 250
City Engineer.

FRANK DEITRICK, 251
City Clerk.

S. B. COLE, 252
Street Commissioner.

E. H. CHASE, 253
Receiver of Taxes.

FRANCIS M. NICHOLS, 254
Mayor.

WM. J. HARVEY, 255
President, Council.

GEO. A. ST. JOHN, 256
First Assistant Engineer, Fire Department.

WM. BRIGGS, 257
Chief of Police.

GEO. J. STEGMAIER, 258
Chief Engineer, Fire Department.

CITY OFFICIALS OF WILKESBARRE.

## CITY GOVERNMENT OF WILKESBARRE.

Wilkesbarre, Pa., is not only a beautiful, wealthy and growing city, but one whose municipal administration reflects the progressive spirit of its people. The city, which is located in the heart of the great anthracite coal fields, has a population of about 55,000, and few cities of that size can vie with it in local improvements and public services. There are over twenty-five miles of paved streets, of which about ten miles are of asphalt. The total cost of the city's paving to date has been nearly $800,000. From June 6, 1882, to January 1, 1897, the sum of $370,688 was expended for the construction of sewers, and today the city has a complete sewerage system, fully adequate to all the demands made upon it. There are nineteen public schools, with a total seating capacity of 8,482; 157 teachers are employed, and the total value of the school property is $450,000. The streets are lighted by over 200

CITY HALL, WILKESBARRE.

electric arc lamps, over 200 gas lamps and nearly 400 naphtha lamps.

Taxable property is assessed at about one-sixth of its actual value, and the assessment for 1896 amounted to $6,877,871. The appropriations for the present fiscal year amount to $170,823, of which $16,341 is for the sinking fund, $25,117 for street lighting, $9,580 for sewers, $8,080 for streets, $27,860 for police, $21,710 for fire department, $19,030 for interest, $2,000 for printing and stationery, $3,460 for public property, $12,100 for salaries, and $7,640 for sanitary purposes.

The fire department consists of nine companies, including four steam engine companies. There are seventeen paid and ninety-five call men, and the efficiency of the force has never been questioned. The police force consists of a chief, two sergeants, one house sergeant and thirty patrolmen.

This issue of CITY GOVERNMENT contains the portraits of Francis M. Nichols, mayor; William J. Harvey, president of the council; Frank Deitrick, city clerk; William V. Ingham, city engineer; Samuel B. Cole, street commissioner; William Briggs, chief of police; Edward H. Chase, receiver of taxes; George J. Stegmaier, chief engineer of the fire department, and George A. St. John, assistant engineer of the fire department.

## POLICE DEPARTMENT.

—Chief of Police Kipley, of Chicago, discharged 408 men from the force by one order, which went into effect October 26. Many of the men removed came on the force under Mayor Swift, just before the civil service law went into effect.

—Director of Public Safety Abbott, of Cleveland, will ask the council to allow the police department fifty more patrolmen. The director claims that the police force at Cleveland is inadequate in numbers, having from 100 to 300 less men than the departments of other cities of similar size.

—James F. Quigley has been appointed superintendent of police at Indianapolis. The new superintendent has served on the force since 1883, beginning as a patrolman and advancing rapidly until he became a captain in 1891. His promotion to the superintendency was earned by efficient service.

—The finance committee of the Los Angeles, Cal., council apparently deems it an unnecessary expense to create the position of humane officer and give him a regular policeman's salary. A petition requesting such action was before the committee, but was answered by a recommendation to the council that the city shall continue to pay $40 toward the salary of any party whom the Humane Society may select.

—In his annual report to the superintendent of police, Mr. Frank C. Mason, superintendent of police telegraph, of Brooklyn, gives some interesting facts. Mr. Mason's department uses 440 sets of telephones, which it rents from the New York and New Jersey Telephone Company at $10 each per year, and ten central office stations. There are now in operation in the city of Brooklyn 353 police patrol signal boxes, and this system, Mr. Mason reports, is giving the best of satisfaction in every precinct in which it has been installed. The total length of wire in underground conduits in the city is now 37,250 feet, and the total length of wire in cables strung from elevated railroad structures is 71,050 feet.

—At Atlanta, Ga., it is proposed to pass an ordinance to prevent crowds gathering about policemen when making arrests. An official of the Atlanta department says: "Policemen are having too much trouble in the making of arrests. I believe some legislation is necessary to break up the practice some people have of gathering about a policeman when he has a prisoner in charge. It would be nothing but right to place the officer who has a prisoner in custody in the same position as a court in session. When an officer has a prisoner he is then the law, and should be so respected. This is the point I make: You can criticise the recorder as much as you please out in the street, but you wouldn't dare to do it in the courtroom while court was in session. Now, a policeman when he has arrested a man and has hold of him should be on the same footing as the court in session, and those who insult him or interfere with him by word as well as act should be arrested. I know there is a sort of general law on the subject, but it is too indefinite and broad in its application. We need a specific ordinance. One man standing in a crowd can, by a very few words, excite a riot. I do not say this to save the feelings of the policemen, for they are expected to take more than any ordinary citizen, but it is in the name of peace and good order that such a law as I suggest should be passed."

# Public Lighting.

—An appropriation of $30,000 has been made for the enlargement of the municipal electric light plant at Jacksonville, Fla.

—An appropriation of $20,000 has been made for the establishment of a commercial lighting system in connection with the municipal electric plant at South Norwalk, Conn.

—It is rumored that New York capitalists are negotiating for the purchase of the gas works at Newark, N. J. The price asked is said to be between $8,000,000 and $10,000,000.

—The several electric companies furnishing arc lights for Philadelphia streets have slightly reduced their rates for 1898. The new rates range from 30 to 37 cents per light per night.

—The city of Merrill, Wis., has made a contract, for five years, with the Merrill Electric Railway and Lighting Company for sixty 1,200 c. p. arc lights for $3,300 per year. This makes the rate $55 per lamp per year.

—The city of Niagara Falls, N. Y., is about to make a five years' contract for electric lights at $84 per light. This is a reduction of $6 from the rate now paid, and the Buffalo and Niagara Falls Electric Light and Power Company is the only bidder.

—Mayor Collier, of Atlanta, Ga., has appointed a committee to investigate the desirability and practicability of municipal ownership of an electric light plant. The committee is already at work, and will give the subject thorough treatment. City Electrician Harper is assisting the committee in its investigation.

—The New Amsterdam Gas Company, of New York city, with a capital of $23,000,000, has filed articles of incorporation at Albany. The new company, it is said, will absorb the interests of several gas companies now doing business in New York, and become a formidable rival of the big Consolidated Gas Company.

—The Minneapolis council has awarded the contracts for street lighting during 1898. The contract for gas lights was given to the Minneapolis Gas Light Company at the rate of $1 per thousand cubic feet. This is a reduction from this year's rate. The gasoline contract was given to W. C. Buchanan at $7.47 per lamp.

—The annual report of the municipal electric lighting plant at Batavia, N. Y., shows that the cost per 2,000 c. p. lamp, per year, was $52.78. Depreciation is not figured in the cost of maintenance, as it is held that it is covered by the item of repairs. The lights were run an average of 9 hours and 19½ minutes per night. The total expenses of the plant for the year amounted to $5,436.56, including insurance, interest and repairs.

—A Worcester, Mass., daily paper says: "The Welsbach street lights have now been in operation in many of the streets for about a month, and have given very general satisfaction. Not a complaint has been heard against their use, and the service has been in every way satisfactory. The light is in many ways the best thing that has yet been found for shaded streets. This has been a problem in all cities since street lighting was begun. The old-style gas burners were effectual, if placed closely enough together, but that meant very close, and a high gas bill resulted. Then came the arc lights, and the problem had been solved, it was thought. But the arc rays were found to lack the properties of the X-rays, and shade trees would cut off the light so that in many streets the sidewalks would be dark within 40 feet of a powerful light. Then the incandescent lights were tried for street purposes, and when new they are successful. They must be placed near together to be effectual, but the character of the light is pleasing. The principal fault is that they grow dim and need more or less frequent renewal. Arc lights can be used, but the objections to them have been stated. Incandescent lights can be used, but they are expensive and weak. Simple gas lights must be placed much closer together, to do the same work, than the Welsbach burners. The Welsbachs burn clear and strong, and it is quite likely that there will be more rather than less of the burners in the city a year from now."

—The city of Lynn, Mass., has received an offer from the Lynn Gas and Electric Company to enter into a five-year contract for street lighting at greatly reduced rates. The city is lighted by 240 arc and 1,160 incandescent lamps. For the arc lamps the rate has been 40 cents per night, and the company's new figure is 32 cents, with a gradual reduction during the five years to 30 cents. The reduction on incandescent lamps is about $2 per year. If the city accepts the company's proposition it is estimated that about $11,000 will be saved annually.

—Consul-General Judd sends the following from Vienna: "The municipal government of the city of Vienna commenced about five months ago to lay their own gas pipes and erect their own gas retorts. They hope to have the entire works for the manufacturing and supplying of gas for its citizens finished by 1899, when the contract between the gas company and the city expires. The gas company has charged 9½ kreutzer (3¾ cents) per cubic meter (35.316 cubic feet) for gas furnished private parties; 7 kreutzer (2.8 cents) for street lighting, and 9 kreutzer for municipal buildings. A monthly rent has also been charged for gas meters. The city authorities have commenced negotiations looking to the purchase of the plant. Thirty-five million florins was the first price asked by the company for its gas works, pipes, etc. This figure was in time reduced to 30,000,000, 25,000,000, and finally to 16,000,000, all of which offers the city declined to entertain, until finally all negotiations were broken off, and the city commenced to lay its own pipes, etc. This arrangement will be expensive to both parties. With the expiration of the contract the old plant will be almost a dead loss to the company, and the new gas works will cost the city more than the price asked for the old ones. A commission appointed by the city to investigate the cost of production of gas has reported that the city will net a clear profit of over 3,000,000 florins ($1,216,500) annually, should the price of gas be the same as the existing company is by contract permitted to charge."

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—A new kind of wood pavement is being laid on North avenue, Atlanta, Ga., furnishing an experiment which will be watched with much interest. The blocks are of solid heart pine, 6 inches square, and 4 inches high. These blocks are laid on a concrete foundation, perpendicular with the grain of the wood, and then melted asphalt is poured over the surface and entering the interstices between the blocks, cements and solidifies the pavement and renders it impervious to water. A layer of asphalt forms the wearing surface of the pavement.

# Water Department News.

—Over 5,000 water meters are in use in Chicago, and a feeling exists that the number might be doubled with great profit to the city.

—Superintendent of Health Schueller, of Columbus, Ohio, is of the opinion that the public water supply of that city should be filtered. It is probable that action toward establishing a filter plant will be taken soon.

—The case of the Lancaster Hotel Company and others against the city of Lancaster, Pa., in which plaintiffs contended that the city could not charge some water consumers by meter rates and others by fixed rates, has been decided in favor of the city.

—The water supply at Allegheny, Pa., is not sufficient to meet the demands of the people on account of the small size of the mains through which it is distributed. Director McAfee and Superintendent Brown recommend the putting in of an entirely new system of 30-inch mains.

—Mayor Mellinger, of Cumberland, Md., has written a strong letter to the State Board of Health protesting against the pollution of the Potomac River water, from which the public supply of his city is derived. Mayor Mellinger criticises the State board rather sharply for what he considers a neglect of duty on their part.

—In the case of the New York Filter Manufacturing Company *vs.* the Elmira Water Works Company, *et al.*, in the United States Circuit Court for the Northern District of New York, the complainant's motion for a preliminary injunction has been granted by Judge Coxe. The court is of the opinion that the filter plant of the Elmira company is an infringement upon the Hyatt patent.

—At Cambridge, Mass., on October 27, a party of over 1,000, including the water board, the city council, heads of departments, and invited guests, made a tour of the practically completed water system of that city. This system, which is the second largest in Massachusetts,, and which has been largely developed within the past few years, is pronounced by experts to be able to furnish an excellent quality of water in a sufficient amount to supply the city at its present rate of growth for twenty-five years to come.

—Mayor McMurray, of Denver, has been served with a notice that the Continental Trust Company, of New York, would apply for an injunction taking away all the powers of the city in dealing with the Denver Union Water Company. Mayor McMurray and the city officials are accused in the petition of having publicly, through the newspapers, recommended resistance to the attempts of the water company to collect its bills. As a result of such action it is claimed that personal assaults have been made upon the servants and agents of the water company, and that very grave injuries, almost fatal in character, have been inflicted upon some of the employees who have been assaulted while carrying out the orders of the water company officials.

—Commissioner of Public Works McGann, of Chicago, has recommended a rearrangement of the present system of water-rate assessment, methods of making collections and general business management of the water department. The move grows out of the recent investigation of that department proving conclusively that wholesale fraud and corruption has been practiced upon the public through the medium of the water office under all administrations. It is the intention to provide a uniform rate of assessment and eliminate the rebate sytem. No extras, it is advised by the commissioner, shall be charged in the ordinary consumption of water. It is also proposed to make the charge lowest to those who use the most, and in all cases to relieve the commissioner of public works of discretionary power.

—The commissioners of the District of Columbia will petition Congress for legislation which will permit the gradual introduction of water meters at Washington. This action has been decided upon after a most thorough investigation of the meter question by the commissioners. Engineer Commissioner Black has been gathering statistics, and, in a recent interview, said: "Boston, according to readings of the water meters, uses but 59 gallons per capita per day in the highest class apartment houses. In Brookline the average consumption of water to dwellings supplied by meter is 44.3 gallons per capita per day. Newton gives the per capita daily use of water in all houses supplied with modern plumbing to be 26.5 gallons, while in the same town the per capita consumption to those houses supplied with but one faucet is but 6.6 gallons daily. In Fall River the most expensive houses use but 25.5 gallons per capita per day, while the average class of houses, generally having bath and water closets, use but 8.4 gallons per capita per day. Coming now to Worcester, the average per capita consumption daily of the whole city is but 16.8 gallons. In London, where the meter system prevails to a large extent, houses renting from $250 to $600 each, having bath and two water closets, are given as using but 25.5 gallons per capita per day, while the middle class of houses, with an average rent of $200, use but 18.6 gallons per capita per day."

—John Kenny, water assessor of Hoboken, N. J., recently investigated water department methods at Newark, and reported as follows: "At Newark they have thirteen inspectors steadily employed, whose duty it is to report at least once in each six months on every piece of property in their respective sections liable to be assessed for water rates. When a building is about to be erected, the builder, on applying for a permit, has to pay for the water to be used in its construction. When the building is finished the inspector must see that the water is turned off. When the owner is ready to rent the building he makes application to the assessor to have the water turned on. From that date the water rents are charged against the building. This seems to be an equitable rule. The system here is to charge the building with everything from date of taking out the tapping permit. Both builders (those who build houses for sale) and property owners complain of this method as being unjust. They say they should not be charged for water they do not use, as it takes several months to complete a building from the date of taking out the tapping permit. The assessor in Newark makes any corrections that may be necessary, but it is rarely that he has to do so, owing to the fact that an assessment is made every six months. They collect their water rents twice a year, on the first of May and November. Should the rents be not paid within those dates the owners are served with a five days' notice that the water will be cut off."

—The contract between the city of Denver and the Denver Union Water Company says that the water rates to be charged in Denver shall be the average of the rates of St. Louis, Chicago and Cincinnati. In the litigation to adjust the rates the city has filed a complaint in which the average of the rates of the three cities and the prevailing Denver rates are stated as follows:

| | Average Three cities. | Denver Rate. |
|---|---|---|
| Residence 1 or 2 rooms | $2.63 | $4.00 |
| Residence 3 rooms | 3.28 | 4.00 |
| Residence 4 rooms | 3.89 | 4.00 |
| Residence 5 rooms | 4.83 | 4.80 |
| Residence 6 rooms | 5.59 | 4.80 |
| Residence 7 or 8 rooms | 6.52 | 5.60 |
| Residence 9 or 10 rooms | 7.59 | 6.40 |
| Residence 11 or 12 rooms | 8.53 | 7.20 |
| Residence 13 or 14 rooms | 9.14 | 8.00 |
| Residence 15 or 16 rooms | 10.05 | 8.80 |
| Residence 17 rooms | 10.90 | 9.60 |
| Residence 18 rooms | 11.28 | 9.60 |
| Residence 19 rooms | 11.71 | 10.40 |
| Residence 20 rooms | 11.81 | 19.49 |
| Store rooms 12½ feet or less | 2.99 | 4.00 |
| Store rooms over 12½ feet to 18 | 3.28 | 6.40 |
| Store rooms over 18 feet to 25 feet | 4.16 | 9.60 |
| Store rooms over 25 to 27½ feet | 9.21 | 12.00 |
| Store rooms over 37½ to 50 feet | 10.66 | 13.00 |

—L. N. Case, superintendent of the Detroit water works, when he appeared before the Senate Committee of the Michigan State Legislature to oppose the free water bill, spoke as follows regarding the use of meters: "There has been found but one really efficient restriction to waste, and that is the meter. The meter prevents the introduction of uses which the consumer is unwilling to pay for. For years, and up to 1889, Detroit, Buffalo and Philadelphia operated upon the assessment plan entirely. Detroit, in 1888, pumped a daily per capita supply of 204 gallons. Our capacity was more than exhausted, and complaints of short supplies were bitter and unceasing. March 6, 1889, I demonstrated to the board that meters must be used to stop this enormous waste, or an enlargement of the works be entered into immediately at an estimated expense of $600,000. The introduction of meters was decided upon. The following conditions of these three cities in 1887 and 1896 will show the results of the introduction of meters in Detroit and the continuance of the old method in Buffalo and Philadelphia:

DAILY PUMPAGE IN MILLION GALLONS.

| | Buffalo. | Philadelphia. | Detroit |
|---|---|---|---|
| 1887 | 38 | 88 | 36 |
| 1896 | 101 | 239 | 36 |

INCREASE OF POPULATION.

| Buffalo. | Philadelphia. | Detroit. |
|---|---|---|
| 34 per cent. | 46 per cent. | 56 per cent. |

Detroit, at the same rate of increase of Buffalo and Philadelphia, which corresponded exactly with her increase previous to using meters, would have pumped 101,000,000 gallons. This would have required an expenditure of over $2,000,000 for engines and pipes more than was expended, and an extra expense for pumping water of $94,900 for last year, with a proportionate increase for the intervening years.

## MUNICIPAL IMPROVEMENT NOTES.

—Rudolph Hering, of New York, has been engaged as consulting engineer with Ernest Adam in the construction of the new million-dollar sewer system at Newark, N. J.

—A. J. Murphy has been given the five-year garbage collection and disposal contract of the city of Chicago. His bid, $250,270 a year, was the lowest of the ten submitted. Mr. Murphy will use the Wright system of cremation, now in successful operation at Hamburg, Germany.

—New London, Conn., under a contract just awarded, will have its streets cleaned and garbage removed for one year for the sum of $3,344. The city is divided into seven districts for this work, and in one district the waste and garbage is to be removed every day except Sunday; in the other districts the cleaning is to be done twice a week.

—Mayor Taggart, of Indianapolis, will endeavor to secure the establishment of free public baths in his city next year. He says: "I have no definite plan in mind, but the institution should have baths for women, baths for men and baths for children, with attendants supplied by the city. The equipment should consist of all that is found in the best bath houses and the cost to the public of taking baths will be nothing. I would doubt somewhat the propriety of locating the institution on the canal, but it should be situated somewhere where reservoirs can be filled and refilled with pure water as needed."

—It is reported that the formation of a sewer pipe trust is under way. The idea of a combination of these interests is by no means a new one. In fact, a sort of double combination was in effect from February 15, 1895, to about July, 1896. The main association was composed of three branches. One of these, the Central Company, controlled the output of twenty-seven fire-clay factories of Ohio; a second, the Union Company, handled the stock of seventeen Akron, Ohio, companies; while the third, known as the New York State Association, was composed of three concerns in this State. Except for a company at St. Louis, one or two near Chicago, and a few in the Southern States, these three associations included practically the entire trade. The combination was broken in the summer of 1896, however, and since then the various companies have been working independently. The plan now proposed is that of actual amalgamation on practically the same basis as that adopted by the Standard Oil Company. Negotiations for a consolidation were commenced last December and officers elected, but the movement seemed to lose strength and did not materialize.

—A. H. Shuck, a taxpayer, has begun injunction proceedings to restrain the city of Reading, Pa., from carrying out an asphalt paving contract with the Pennsylvania Asphalt Company, of Philadelphia. The bill alleges that giving the contract to this company shuts out all competition, and places the taxpayers at the mercy of a monopoly. It contends, under oath, that prior to 1894 there was competition between the Trinidad Paving Company, which controlled all the Trinidad pitch lake asphalt, and the New York and Bermudez Paving Company, which controlled the asphalt coming from Bermudez. It is alleged that now these two companies have come to an understanding and so no longer compete with each other, and that the right to the use of the Trinidad asphalt in Reading is owned by the Barber Company, while the Bermudez grade is under the control of the Pennsylvania Asphalt Company. It is charged that the two latter are subordinate companies to the two previously named, and have an agreement with reference to paving in Reading (the same as their alleged agreement in Philadelphia), and that all paving in Reading is to go to the Pennsylvania Company. It is alleged in the bill that the Barber Company's bid for Reading was $2.32 per square yard, yet it had done similar work for $1.25. It was contended by counsel for the plaintiff that because the specifications called for Trinidad pitch lake or Bermudez asphalt it shut out all competition, as these two kinds of material were practically under the control of one man, who not only controlled the source of supply, but its application in this country.

# Fire Department Notes.

—Jacob Kraus is the new chief of the fire department at Rahway, N. J.

—Frank McGee has succeeded Thomas Wilkinson as chief of the fire department at Dallas, Tex.

—A fireboat pipe line has been put in at Buffalo and successfully tested. The system will be extended.

—The running team of the First Ward Hose Company, of Butler, Pa., during its six years of existence has won $2,750 in prizes.

—The fire department of Elmira, N. Y., has just put into service a combination chemical and hose wagon. The apparatus cost $1,300.

—T. A. Compton has resigned as chief of the fire department at Independence, Mo., and John Nesbitt has been appointed acting chief.

—The Board of Aldermen of Salem, Mass., have voted to increase the salary of the chief engineer of the fire department from $600 to $1,000 a year.

—A paid fire department is being urged at Washington, Pa. It is thought, however, that it will not be possible until Washington is consolidated with the surrounding boroughs.

—Chief Barrett, of the Indianapolis Fire Department, suggests that special electric cars be built, with runways, for the transportation of fire approaches to suburban towns.

—The Albany fire officials are so well pleased with the work of chemical engines that they have recently added two more to the service, and propose to have all the fire houses in the city supplied with chemicals at an early date.

—Officers of the Merrill, Wis., fire department have been elected as follows: Patrick Love, president; Thomas J. Sullivan, secretary; James Clifton, treasurer; John W. Cotey, chief; Martin Olson and Joseph Bartelme, assistant chiefs.

—John W. Regan, first assistant engineer of the Boston fire department, has been retired, having passed the age limit of sixty-two years. Chief Regan has been in the service continuously for forty-four years, and is one of the best known fire fighters in the country.

—The fire commissioners of Hartford, Conn., have decided that hereafter men appointed to the force must not be less than 5 feet 7 inches tall and weigh not less than 135 pounds. It has also been decided to establish a pension fund for the department and a training school for horses.

—The fire commissioners of St. Paul, Minn., have awarded the contract for a new fire alarm system to the Gamewell Company. The new equipment will cost $9,940, and is known as the manual system, with storage batteries. The contract calls for a complete central office, with thirty circuits.

—L. P. Weber, chief of the fire department of Boston, has entered upon his fourteenth year of service in that position. The fact is interesting because the office has never been occupied so long by one man in the history of the modern department, and we doubt if it has in the history of the city. This was an instance where the office sought the man, and the results have been good.

—The proposition of establishing a paid fire department is being agitated at St. Augustine, Fla. F. H. Greatorex, chief of the volunteer department, estimates that a force of thirteen men and two horses would be needed. This service would entail an expense, according to the chief's figures, of more than $6,000 per annum, a sum out of the reach of the city's present financial condition.

—Chief Joyner, of Atlanta, Ga., has for the past several years been trying to induce the city authorities to allow him to purchase a water tower. At the Columbus convention of the League of American Municipalities Mayor Collier and the councilmen of Atlanta witnessed the exhibition given by the Columbus Fire Department, and they were so favorably impressed with the work of the water tower that they will now probably authorize Chief Joyner to make the desired addition to the apparatus of his department.

—On the night of October 18 occurred the first fire of any magnitude in Baltimore on which the combination chemical engines were used. The fire companies that responded on the first alarm were equipped with combination wagons, and the chemicals were used exclusively to extinguish the fire. "Had we used water," said Chief McAfee, "the damage would have been twice as great. The work of the chemicals demonstrated the wisdom of adopting the combination equipment, and that chemicals are of great value in handling warehouse fires."

—The Revere Rubber Company recently sold a quantity of fire hose to Greenfield, Ind., and were supposed to guarantee it for four years. When the hose burst it was pointed out that the guarantee read that the hose was to stand 400 pounds pressure "at time of shipment." The city threatened to have the courts construe the meaning of this peculiar guarantee, but the company fixed matters by taking the hose back and supplying a better quality. The Revere Company state that the agent who sold the hose was "crooked" and has been discharged.

—In his final report to the council, Mayor Ochs, of Chattanooga, Tenn., spoke of the fire department as follows: "The fire department was managed with economy and good judgment. The expenses for the year fall considerably below the estimates. The department is in excellent condition, with fine equipment. Some additional purchases of hose are necessary, but these will probably be made in the near future. Chairman Wilcox, of this committee, has kept close supervision over this department, and merits especial praise for the economies practiced, as does Hon. J. C. Howell for his brilliant record as chairman in the four years preceding."

—The new rules just issued by the board of fire and police commissioners of Milwaukee provide several changes in the manner of appointing and trying members of the police and fire departments. Every member of the departments, except the chiefs or first assistants, will, when accused of an offense, be entitled to a hearing before the chiefs of their department, and must be served with written charges or complaints preferred. Notices of hearings must be given the commissioners twenty-four hours previous to the time set for the hearing. Another important clause provides that "whenever there is a vacancy to be filled by appointment or promotion in either the fire or the police department, the chief of such department shall make a requisition in writing upon this board for the names of persons eligible to such position, and the chief examiner shall thereupon transmit to the chief requesting twice as many names, taken from the

eligible list in the order of their standing, as there shall be vacancies to fill; and the name or names of the person or persons appointed or promoted to fill such vacancy or vacancies shall be taken in from the list of names so certified; but in cases of original appointments, such appointments shall be made in the order in which the names stand on such list whenever practicable."

—In an editorial urging the payment of pensions to firemen, the Atlanta, Ga., *Journal*, says: "No class of citizens deserve in a higher degree the respect and gratitude of the public than brave, honest, faithful firemen. The performance of duty often calls them to risk their lives, and only in very rare cases have they been known to fail to come up to the highest requirements of a situation. There is seldom a great fire at which there is not an exhibition of heroic courage and endurance by one fireman or more. The record of their deeds of daring would make a volume to illustrate the noblest possibilities of human nature. Many a fireman has lost his life when he would have saved it but for his efforts to rescue others. None but men of the best character and the truest pluck should be selected for this service, and those who are found worthy should receive liberal encouragement and reward."

—The accompanying illustration shows Captain Burns, of Hook and Ladder Company 1 of the New York Department, equipped with a "Midget" smoke protector. This device is exceedingly simple in arrangement, but very effective in operation. The claims made for this appliance are that it combines the good qualities of being practical as well as safe, reliable and efficient.

It cannot get out of order, and is always ready for use. As will be seen by the cut, it protects the nose, mouth and eyes, and its greatest merit is that it is of such a convenient size that it can be carried in the pocket without any inconvenience whatever. Captain Burns has used one of these protectors with good effect at a number of fires, and expresses entire satisfaction with it and says that he would not be without it for any consideration. In the official report of the committee on exhibits at the convention of the International Association of Fire Engineers at New Haven this smoke protector was highly recommended and indorsed as being an extremely practical device.

## PERSONAL.

—Mayor Baum, of Saginaw, Mich., is going to attend the national convention of mayors and councilmen at Columbus.

—Thomas J. Montgomery has been elected president of the new council at Indianapolis. The council is composed of seventeen Democrats and four Republicans.

—John T. Wheelwright has been appointed a temporary member of the Boston park board by Mayor Quincy. Mr. Wheelwright is assistant corporation counsel.

—Col. Edward Watkins has been inaugurated as mayor of Chattanooga, Tenn. He is in every way fitted to continue the good work for improved municipal conditions so well begun by the former mayor, George W. Ochs.

—F. W. Cappelen, the well-known city engineer of Minneapolis, Minn., thinks it will pay any large city to equip a first-class asphalt plant, buy the raw material in the open market and then do its own paving and repairing.

—Mayor J. C. Bush, of Mobile, Ala., has been making a tour of the Southern cities to investigate water supplies, sewerage systems and other public works. The city of Mobile recently voted to issue bonds for $500,000 for water works, and $250,000 for sewers.

—John P. Quigley has been appointed chief of the fire department of Syracuse, N. Y. He has been a fireman since his youth, having begun his service as a hoseman in Engine Co. No. 1, in 1878, when he was twenty-one years of age. Three years later he was made engineer of that company, and July 1, 1886, he was promoted to be second assistant chief. Upon the death of Chief Henry Reiley in 1895 he was made first assistant chief.

## SPEAKING OF PAVEMENTS.

The Rochester *Herald* makes the statement that one kind of asphalt is as good as another, and says that Bermuda, Vulcanite, Rock Asphalt, Trinidad Land Asphalt, Alcatraz and others have been put down with gratifying results in various cities in this country. We believe what the *Herald* says. Pavement makers who remain in the business year after year must manufacture a good article, else they would be forced to fail. Local officials who appear to be in terror lest some other brand of asphalt than that sold by the Warren-Scharf Company is bought by Binghamton, should do a little investigating outside of Binghamton, and when the facts and figures are submitted to show that they are wrong, they should acknowledge their error like gentlemen. It is probably within the bounds of truth to say that all kinds of asphalt pavements at present on the market are good, and if properly put down will give satisfaction; therefore, there is no reason why the city of Binghamton should not strive to induce asphalt companies to compete with each other freely when there are any paving contracts to be let in Binghamton. It must be said, in all truth, that the taxpayers are not satisfied to think that one company has put down all the asphalt pavements manufactured in this city during the past nine years. For the sake of the appearance of things lively competition should be invited. —Editorial in Binghamton, N. Y., *Herald*.

# Items of Interest.

—The Utica Paving Company was awarded the contracts for paving Main and Washington streets, Binghamton, N. Y. Alcatraz asphalt will be used.

—CITY GOVERNMENT is a thought-provoking publication. Every alderman and city official in the country should have his name placed upon the magazine's subscription list.—*Bay City, Mich., Tribune.*

—Chief James Sprake, of the Plymouth, Pa., fire department, writes to the Gleason & Bailey Manufacturing Company as follows: "Allow me to compliment you on the wagon you sold our borough about a year ago, for it won the State fireman's prize at Wilkesbarre for the handsomest wagon in line."

—The Sawyer Electric Company, of Philadelphia, has moved its offices from the Lippincott Building to the Sawyer Building, 1308 Arch street. The company occupies the entire building at the latter address. The change was rendered necessary on account of the large increase in the company's business.

—Philadelphia Gas Improvement Company, of Philadelphia, are increasing their plant by erecting a new fireproof pipe shop, constructed entirely of iron. The building has steel framework and a corrugated iron covering. Contract for erecting the building has been let to the Berlin Iron Bridge Company, of East Berlin, Conn.

—The private police of Cincinnati have been ordered to cease wearing uniforms resembling those of regular policemen. They must wear light blue caps without wreaths. Chief Deitsch says the private police enter saloons and other places, where regular police are not permitted to go, and that the similarity of uniform makes a bad impression for the regular police.

—The New Jersey Car Spring and Rubber Company, of Jersey City, have recently issued a new catalogue, which is artistically illustrated and printed. It contains pictures of the immense mills of the company, and also illustrates the various goods made. The New Jersey Car Spring and Rubber Company are keeping up with their record for progressiveness in issuing such a handsome catalogue.

—The Daylight desk lamp, manufactured by the Waring Supply Company, New York city, gives an abundance of soft light, which renders it almost indispensable in dark offices. The light is so well distributed that no shadows are thrown on the desk, and at the same time the eyes are protected. The company reports that this


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THIS IS OUR RECORD FOR 1896:

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|---|---|
| JANUARY 1st, 1897, NUMBERED AND SOLD METER | 88,981 |
| JANUARY 1st, 1896, NUMBERED AND SOLD METER | 73,525 |
| METERS SOLD IN 1896, | 15,456 |
| METERS SOLD IN 1895, | 14,076 |
| INCREASE OVER 1895, | 1,380 |

We Stamp our Meters only as we sell them.

**Number of Meters sold to date, 102,952.**

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**System of Police Signal and Intercommunication**

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Installed in the following; among many other prominent cities; each of the successive sixteen police precincts equipped since 1886 in the City of Boston, Mass., Newark, N. J., Fall River, Mass., Albany, N. Y., Manchester, N. H. In operation absolutely non-interfering, and **CAN ALONE LEGALLY**, distinguish important or Emergency signals, from less important, or on-duty signals. Municipalities contemplating the installation of a Police Signal and Intercommunication System will on investigation feel assured of its positively reliable and at all times effective work. . . . .

**MUNICIPAL SIGNAL COMPANY,**

Estimates, Descriptive Matter, ... References ...

28 STATE STREET, BOSTON, MASS.

lamp is growing in popular favor and that it is doing well with them.

—Superintendent William J. McKelvey, of the Brooklyn Police Department, resigned to accept the Citizens' Union nomination for register of Kings County. The Democratic landslide in Greater New York carried him down with all the other candidates on his ticket. Mr. McKelvey, who served on the Brooklyn force with the utmost efficiency for over a quarter of a century, will receive a pension of $2,500 a year.

—The Puritan Electric Company has moved its office from 150 Nassau street to the Bowling Green Building, 11 Broadway, New York city. In its new quarters the company has increased facilities for handling its alternating-enclosed arc lamp. The change of location was rendered necessary on account of the large increase in business experienced by the company. Since the fall season began this increase has been marked, and it has taxed the productive facilities of the company to the utmost.

—Mr. R. B. Corey, 711 Havemeyer Building, New York, has been appointed agent in the metropolitan district for the Amorite Interior Conduit Company, of Pittsburg. The Amorite conduit has been approved by the board of fire underwriters and the fire department of the city of New York. It is a superior insulated conduit, is flexible, and can be bent into any shape, while cold, by the workmen. Mr. Corey is a business man of rare ability, and with such a meritorious article as the Amorite conduit he will doubtless build up a large trade.

—The Newport News Ship Building and Dry Dock Company, of Newport News, Va., are erecting at their shipyard a crane capable of lifting 140 tons. This crane is to be used for the placing of engines, boilers and other machinery in the large war vessels which they are constructing for the Government, and will be also used for placing on the sides of these vessels their armor plates, some single pieces of which weigh from 40 to 50 tons. The crane will have sufficient reach so that it will cover the entire width of a large cruiser. This crane revolves in a circle on a turn-table, which is supported on a steel foundation about 25 feet high. This steel foundation is to carry, besides its own weight, the weight of the crane, its machinery, and whatever load may be lifted, which, altogether, will aggregate 900 tons. The steel support for this crane is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.


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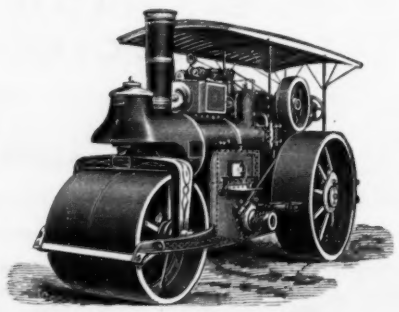

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Street Curbing and Flagging a specialty. Correspondence solicited.

—The Vajen-Bader Company, of Indianapolis, recently sold six of their well-known helmets to the New York fire department and twelve to the United States Navy.

—The Collins Company, of Collinsville, Conn., in order to better their facilities and to meet the demands of their increasing business, are making extensive improvements in their plant at Collinsville, and have placed the contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for a large addition to their forge shop. The new construction will be entirely of iron in order to have it fireproof, no woodwork being used in the construction.

—The New Jersey Car Spring and Rubber Company, of Jersey City, N. J., is about to open a splendidly equipped store at 175-177 Lake street, Chicago. This fine double store has been remodeled and fitted up in a most thorough manner. A complete stock will be carried, including the full line manufactured by this well-known concern, and will include all the different grades of hose, belting, packing, mats, mattings, linen and cotton hose, etc. The New Jersey Car Spring and Rubber Company is one of the pioneers in the trade, having been established since 1858. They are progressive, and have a fine up-to-date plant, with every new appliance in the way of machinery to make their goods quickly and well, and the opening of the Chicago store is looked for with interest by the trade. The store will be conducted under the management of Frederick G. Davis, who is well and widely known by buyers and users of mechanical rubber goods. Mr. Davis brings to his duties an extensive experience, and as the products of the New Jersey Car Spring and Rubber Company are of known reputation and worth the success of this new move of the company seems assured from the start.

—A trial was made in the police cells in Portsmouth Dockyard on Tuesday of the Vajen-Bader patent smoke protector for firemen, which consists of a helmet-shaped head covering, fitted with mica eye pieces, and supplied with fresh air from a reservoir containing 100 pounds of air. In one of the police cells, which was hermetically sealed, two fires of cotton waste, leather, and other substances calculated to emit suffocating fumes were lighted in a bogy. Among the officials who witnessed the trial were Commander Cuddy, of the Dockyard Reserve; and Mr. J. A. Yates, chief constructor, and Mr. J. T. Corner, chief engineer of the dockyard. As soon as the cell door was opened a constable wearing the helmet entered and stirred the fires, remaining in the cell for twenty minutes, when he had to be released owing to the heat. Commander Cuddy then entered and remained for ten minutes. It was considered that the trial was a complete success, and that the helmet would be valuable in enabling men to discover the locality of a fire in the confined spaces of a ship.—*London Times*, September 10.

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REGISTERED

It has come to our notice that reports are being industriously circulated to the effect that THE ALCATRAZ COMPANY has sold out its interests to the Trinidad-Bermudez combine and that the production and use of Alcatraz Asphalt is controlled by such combine. Such reports have been circulated more particularly in Buffalo, Cleveland, Erie, Detroit, Saginaw and Hoboken, cities in which Alcatraz Asphalt has come into direct competition, at the recent lettings, with the asphalt of the Trinidad-Bermudez monopoly.

These reports have been circulated evidently with malicious intent, to deceive the municipal officers and taxpayers of cities throughout the United States by leading them to believe that GENUINE COMPETITION could not be obtained from the bids of those using ALCATRAZ ASPHALT.

We declare all such reports and rumors to be absolutely and entirely false.

NEW YORK, August, 1897.

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WILLARD T. BARTON, General Eastern Manager.

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U. S. Fire and Police Telegraph Co., 246 Washington St., Boston.

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Wm. B. Pollock & Co., Brier Hill, Ohio.

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**CEMENT.**
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A. W. Dolfini & Co., 140 Nassau St., New York.

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Pierce & Richardson, 315 Dearborn St., Chicago.
Alexander Potter, 137 Broadway, New York.
Frederick Reckenzaun, 44 Pine St., New York.
David C. Sanford, 87 Church St., New Haven, Conn.
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G. A. Goebel, 199-201 Madison St., Chicago, Ill.

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National Conduit and Cable Co., Times Bldg., New York.
Okonite Co., 253 Broadway, New York.

**NOZZLES.**
A. W. Dolfini & Co., 140 Nassau St., New York.
New Jersey Car Spring and Rubber Co., Jersey City, N. J.
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Austin & Western Co., Ltd., Chicago.
O. S. Kelly Co., Springfield, Ohio.
Russell & Co., Massillon, Ohio.
St. Johnsville Agricultural Works, St. Johnsville, N. Y.

**SAFES AND VAULTS.**
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A. W. Dolfini & Co., 140 Nassau St., New York.
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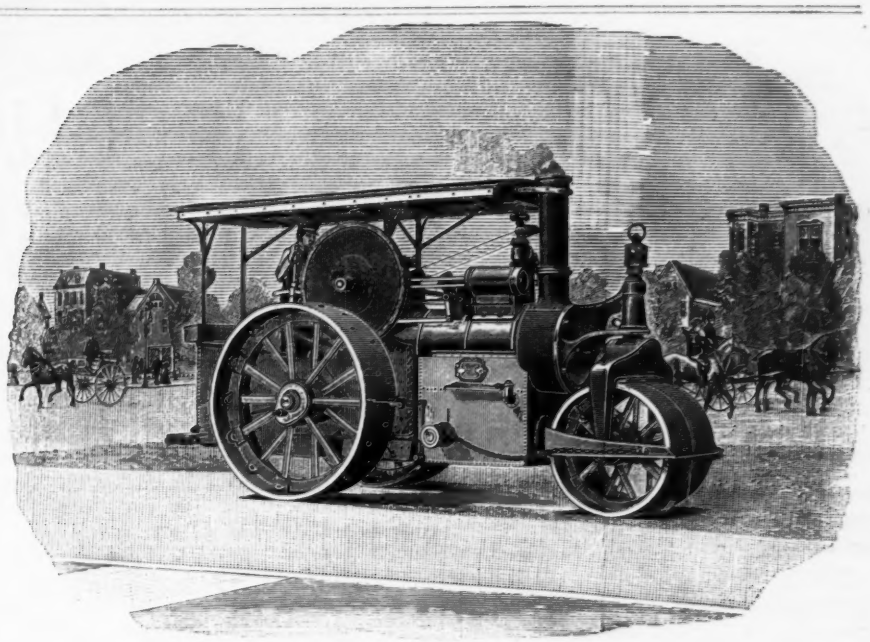

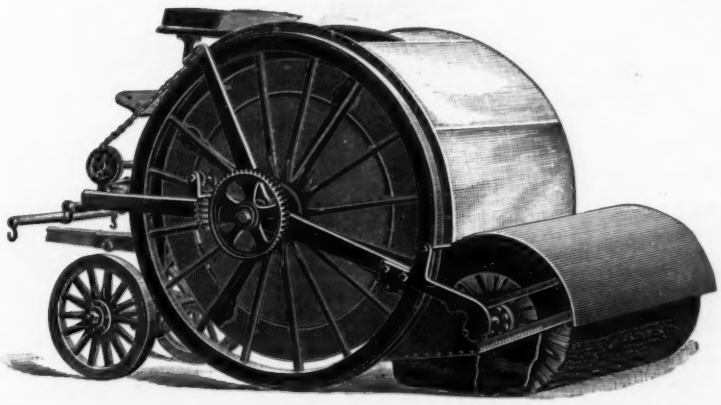

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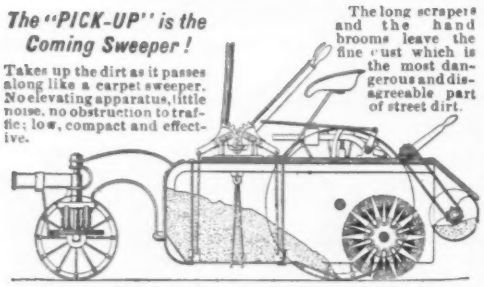

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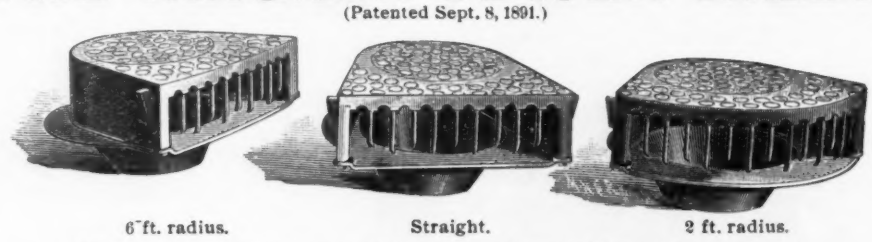

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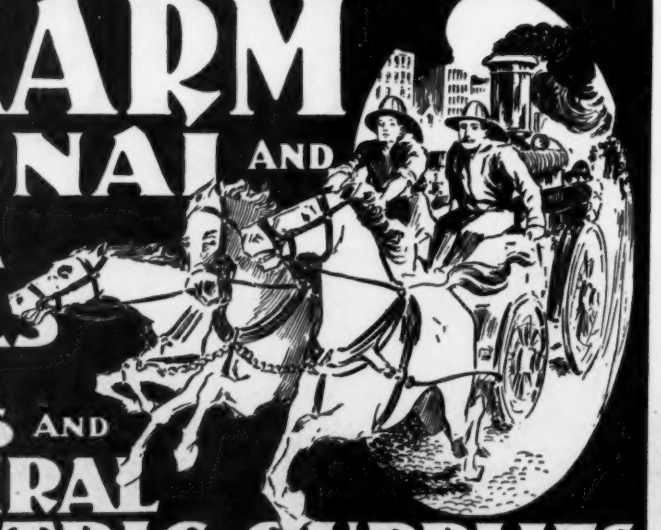

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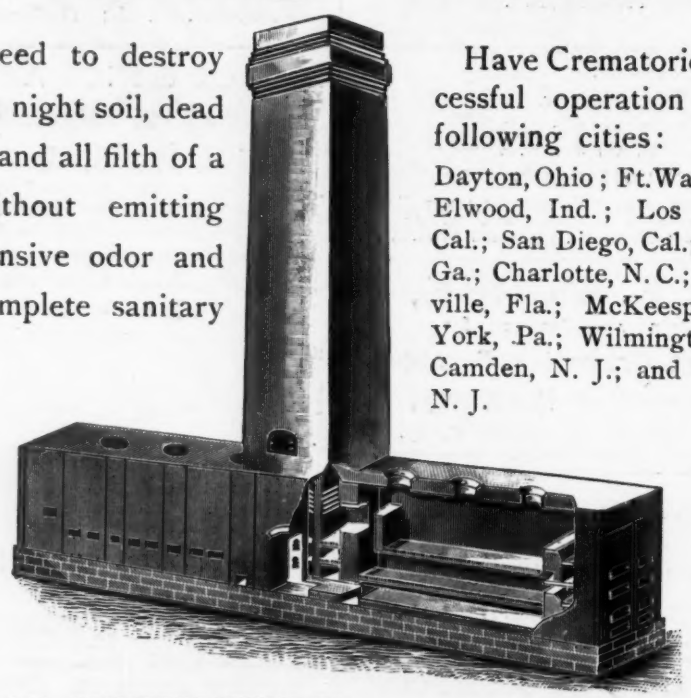

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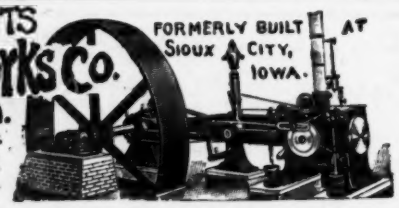


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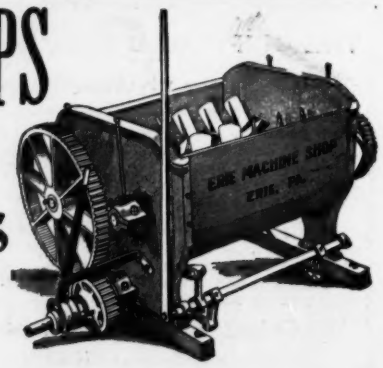


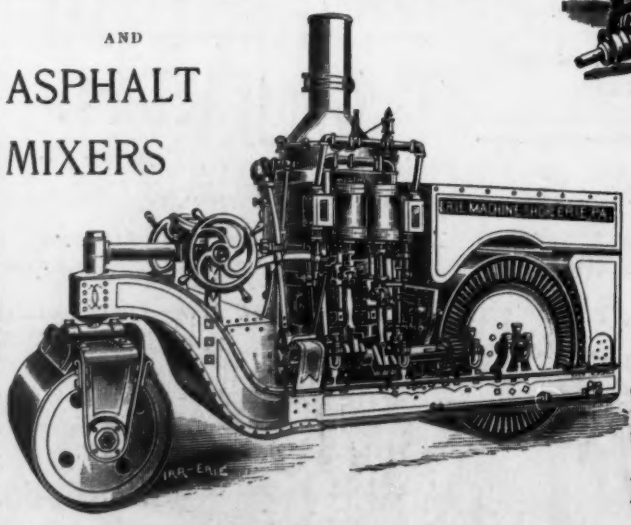


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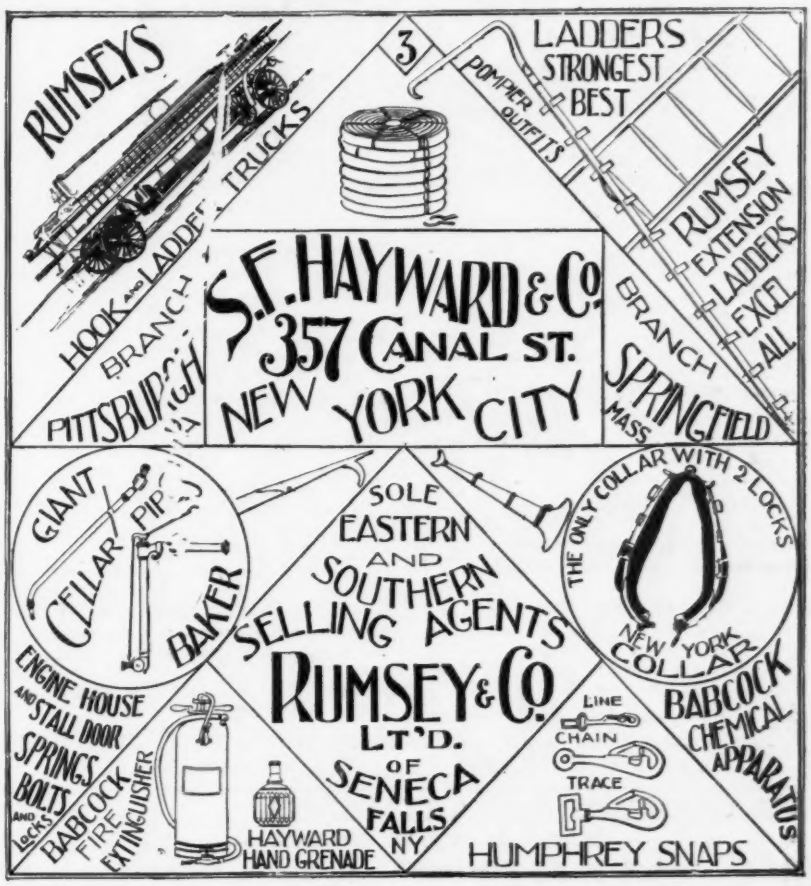


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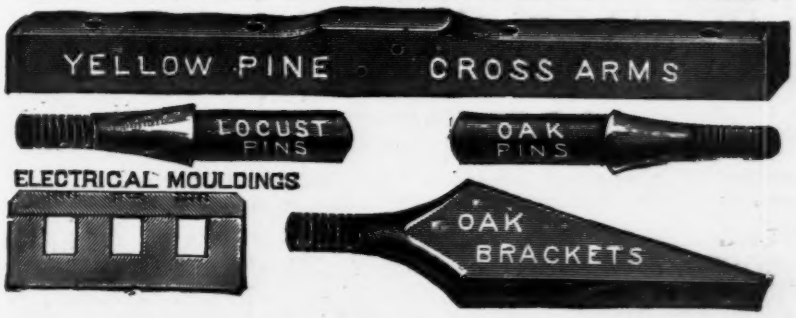


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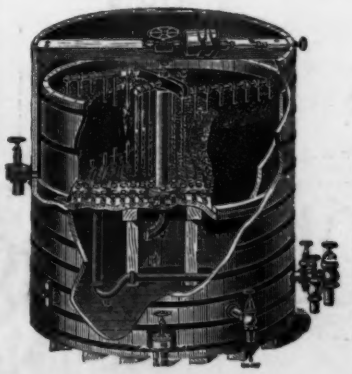

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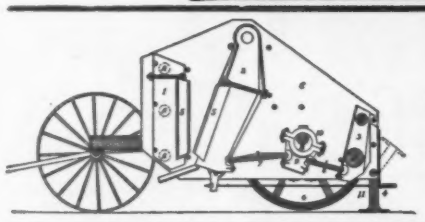

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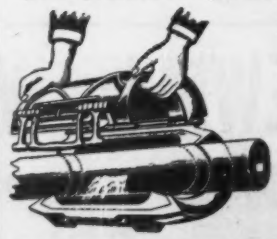

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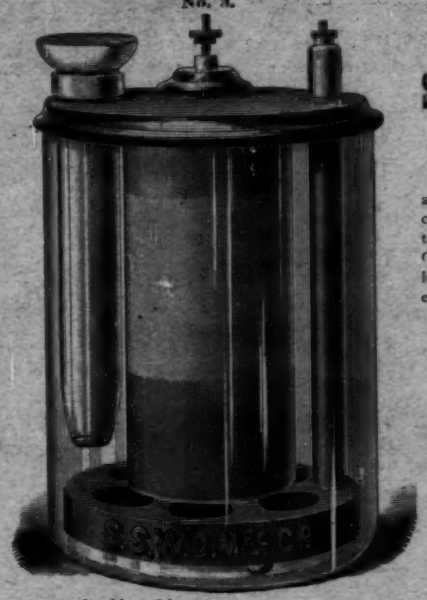

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Do not procrastinate, but buy at once. 25,000 trussed ladders in use and NOT ONE MAN was ever killed by one of them breaking.

Economize. Trussed Goods handled by half the men required by old-style goods.
We have sold over 100,000 Lineal feet of Trussed Ladders since January 1, 1897.
Save life and property with trussed goods.

— THE —

# CONTINENTAL FILTER.

Double Filtration without Alum or other Coagulants.
Thorough Washing and Aeration of Filter Beds.
No Expert Care Necessary.
No Expense for Operation and no Renewals Required.

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## CITY, TOWN AND VILLAGE WATER WORKS,

Mills, Factories, Hotels, Hospitals, Baths, Dwellings, Etc. Filtration of Artesian Well Waters a Specialty.

## CONTINENTAL FILTER COMPANY,

44 WALL STREET, NEW YORK.

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## CAST IRON PIPE

AND SPECIALS FOR WATER AND GAS. ALSO FLANGED PIPE AND FITTINGS.

CULVERT PIPE.

WROUGHT IRON PIPE, FITTINGS, VALVES.

Supplies of all kinds for Steam, Water and Gas, at Lowest Prices.

CHAS. MILLAR & SON, Selling Agents, Utica, N. Y., Manufacturers of LEAD PIPE & PLUMBERS' MATERIALS, Wholesale Eastern Agents Akron Vitrified Sewer Pipe.

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# WE SEEK TO RAISE A DOUBT

—and the soil in which we seek to raise it is your mind—'t is this:

We wish to make you wonder if it would not be a costly oversight on your part not to communicate with us when in want of any modern Fire Appliances.

More than fifty years concentrated upon the production and perfection of fire extinguishing apparatus have borne their legitimate fruit in a line of goods recognized as leaders the wide world over. Among countless other goods we make the following specialties:

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| Aerial Trucks for Life Saving | Fire Extinguishers | Hose Carriages | Patrol Wagons |
| Swinging Harness | Chemical Engines | Hose Carts | Hand Fire Engines |
| Flexible Adjustable Steel Collars | Hose Wagons | Combination Pieces | Hook and Ladder Trucks |

Also an exhaustive line of general Fire Department Supplies

We 'put out' fully illustrated catalogues on the subject of 'putting out' fires, these we gladly mail to interested applicants

Works founded 1840 GLEASON & BAILEY MFG. CO. (Advertising Department) 181—189 Mercer St., New York

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PARIS EXPOSITION.
**MEDAL**
FOR
**Rubber Insulation.**

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TRADE MARK.

1893.
WORLD'S FAIR.
**MEDAL**
FOR
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## THE OKONITE CO., Ltd.,
## 253 Broadway, NEW YORK.